

Europäisches Patentamt
European Patent Office
Office européen des brevets



(11) EP 1 378 967 A1

(12) EUROPEAN PATENT APPLICATION

(43) Date of publication:
07.01.2004 Bulletin 2004/02

(51) Int Cl.7: H01R 13/422

(21) Application number: 02019154.0

(22) Date of filing: 30.08.2002

(84) Designated Contracting States:
AT BE BG CH CY CZ DE DK EE ES FI FR GB GR
IE IT LI LU MC NL PT SE SK TR
Designated Extension States:
AL LT LV MK RO SI

- Kawase, Hajime
Yokkaichi-city, Mie 510-8503 (JP)
- Ishikawa, Ryotaro
Yokkaichi-city, Mie 510-8503 (JP)
- Kurimoto, Naoya
Yokkaichi-city, Mie 510-8503 (JP)

(30) Priority: 04.07.2002 JP 2002196441

(71) Applicant: Sumitomo Wiring Systems, Ltd.
Yokkaichi-City, Mie, 510-8503 (JP)

(74) Representative: Müller-Boré & Partner
Patentanwälte
Grafinger Strasse 2
81671 München (DE)

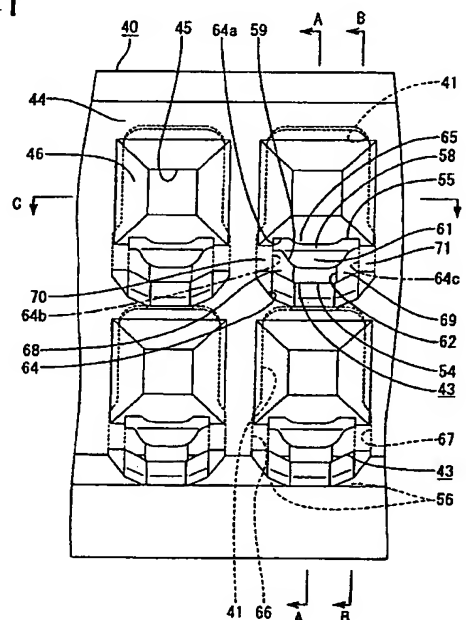
(72) Inventors:
• Nankou, Yuuichi
Yokkaichi-city, Mie 510-8503 (JP)

(54) A connector

(57) To provide a connector suited to being miniaturized.

A female housing is provided with cavities 41 into which terminal fittings are insertable, and locking portions 43 provided in the cavities 41 and resiliently engageable with the terminal fittings being inserted to lock the terminal fittings. Openings 64 formed by removing a mold for forming locking surfaces 58 of the locking portions 43 engageable with the female terminals are so formed in the female housing as to be open forward. Each locking portion 43 is supported at both front and rear ends, and a section thereof projecting more forward than the locking surface 58 is connected with side surfaces 64b, 64c of the circumferential surfaces of the corresponding opening 64 extending along a deforming direction of the locking portion 43.

FIG. 1



Description

[0001] The present invention relates to a connector.

[0002] A connector provided with locking portions for locking terminal fittings so as not to come out is known from Japanese Unexamined Patent Publication No. 6-325814. As shown in FIG. 26, this connector is such that a connector housing 1 is provided with cavities 3 into which terminal fittings 2 are insertable from behind, and a resin locking portion 5 which is resiliently deformable to temporarily enter a deformation permitting space 4 located above by being pushed by the terminal fitting 2 being inserted and is restorable to resiliently engage the terminal fitting 2 when the terminal fitting 2 reaches a proper depth is provided at the ceiling surface of each cavity 3. Each locking portion 5 is comprised of a cantilever-shaped arm portion 6 extending forward and a locking projection 7 projecting inwardly of the cavity 3 from the inner surface of the arm portion 6 so as to be engageable with the terminal fitting 2. Further, a projection 8 used to disengage the locking portion 5 from the terminal fitting 2 projects forward from the leading end of the arm portion 6.

[0003] In the case of a demand for the miniaturization of the above connector, it is considered, for example, to reduce the thickness of the arm portions 6 of the locking portion 5. However, since the arm portions 6 are supported only at one end, a specified thickness has to be secured in order to obtain a necessary strength. Thus, there has been a limit in miniaturizing the connector by thinning the arm portions 6.

[0004] The present invention was developed in view of the above problem and an object thereof is to provide a connector suited to being miniaturized.

[0005] This object is solved according to the invention by a connector according to claim 1. Preferred embodiments of the invention are subject of the dependent claims.

[0006] According to the invention, there is provided a connector, comprising a connector housing, at least one cavity into which a terminal fitting is at least partly insertable, and a locking portion provided in the cavity and resiliently engageable with the terminal fitting being at least partly inserted to lock the terminal fitting,

wherein the connector housing is formed with an opening which is open forward and is preferably left upon forming a locking surface of the locking portion engageable with the terminal fitting,

wherein the locking portion comprises a locking surface for locking the terminal fitting and is supported at both ends, and

wherein a section of the locking portion projecting more forward than the locking surface is connected with at least one side surface of the opening.

[0007] Since the locking portion is supported at both ends, a high strength can be maintained even if the thickness is reduced as compared to conventional locking portions supported only at one end and, accordingly, a force to lock the terminal fitting can be enhanced. Thus, the connector suited to being miniaturized can be provided.

[0008] Further, since the section of the locking portion projecting more forward than the locking surface is connected with the at least one side surface of the opening, this connected section does not hinder the formation of the locking surface, enabling the locking surface to be formed wider. Thus, even if the connector is miniaturized, a sufficient locking force can be secured for the terminal fitting. Thus, the connector suited to being miniaturized can be provided.

[0009] According to a preferred embodiment of the invention, the side surface extends substantially along a deforming direction of the locking portion.

[0010] According to a further preferred embodiment of the invention, there is provided a connector, comprising a connector housing, a cavity into which a terminal fitting is insertable, and a locking portion provided in the cavity and resiliently engageable with the terminal fitting being inserted to lock the terminal fitting,

wherein the connector housing is formed with an opening which is open forward and left upon forming a locking surface of the locking portion engageable with the terminal fitting, the locking portion is supported at both ends and a section thereof projecting more forward than the locking surface is connected with a side surface of circumferential surfaces of the opening which side surface extends substantially along a deforming direction of the locking portion.

[0011] Since the locking portion is supported at both ends, a high strength can be maintained even if the thickness is reduced as compared to conventional locking portions supported only at one end and, accordingly, a force to lock the terminal fitting can be enhanced. Thus, the connector suited to being miniaturized can be provided.

[0012] Further, since the section of the locking portion projecting more forward than the locking surface is connected with the side surface of the circumferential surfaces of the opening which side surface extends substantially along the deforming direction of the locking portion, this connected section does not hinder the formation of the locking surface, enabling the locking surface to be formed wider. Thus, even if the connector is miniaturized, a sufficient locking force can be secured for the terminal fitting. Thus, the connector suited to being miniaturized can be provided.

[0013] Preferably, the section of the locking portion projecting more forward than the locking surface is connected with a pair of side surfaces (of the circumferential surfaces) of the opening which side surfaces preferably substantially face each other.

[0014] Since the width of the locking surface can be extended to substantially equal to the width of the locking portion,

the force to lock the terminal fitting can be even enhanced.

[0015] Further preferably, the section of the locking portion projecting more forward than the locking surface is connected with the side surface(s) (of the circumferential surfaces) of the opening and with a surface of the opening or adjacent thereto substantially normal to the side surface(s) and located at the side of the cavity.

[0016] If the section of the locking portion projecting more forward than the locking surface is connected with the facing side surfaces (of the circumferential surfaces) of the opening, a part of the locking portion where the locking surface is provided may interfere with the terminal fitting depending on, e.g. the shape of the terminal fitting. Even in such a case, according to the present invention, since this section is connected with the side surface (of the circumferential surfaces) of the opening and the surface thereof or adjacent thereto substantially normal to the former side surface and located at the side of the cavity, a formation range of the locking portion is restricted by this connected portions and the interference with the terminal fitting can be avoided.

[0017] Still further preferably, the section of the locking portion projecting more forward than the locking surface is formed with a maneuverable groove which is substantially open forward and is maneuverable by a disengagement jig to forcibly resiliently deform the locking portion.

[0018] In the case of detaching the terminal fitting from the cavity, the wall surface of the maneuverable groove is maneuvered by the disengagement jig to forcibly resiliently deform the locking portion, and the terminal fitting is pulled backward while the locking portion is disengaged from the terminal fitting.

[0019] Further preferably, the disengagement jig can be inserted into the opening for maneuvering the maneuverable groove.

[0020] Still further preferably, a locking projection projecting from the terminal fitting is insertable into the maneuverable groove, and the locking surface is extended preferably to the rear end of the maneuverable groove so that the extended portion of the locking surface is engageable with the locking projection for locking.

[0021] Since the locking surface is extended so as to engage the locking projection projecting from the terminal fitting, the force to lock the terminal fitting can be even more enhanced.

[0022] Most preferably, a jig-introducing groove through which the disengagement jig can be at least partly introduced is so formed at the section of the locking portion projecting more forward than the locking surface as to communicate with the maneuverable groove and preferably to fork or split the section of the locking portion projecting more forward than the locking surface.

[0023] Since the jig-introducing groove is formed in such a range as to fork or split the section of the locking portion projecting more forward than the locking surface, a sufficiently large entrance can be ensured for the disengagement jig by the jig-introducing groove upon inserting the disengagement jig into the maneuverable groove.

[0024] Most preferably, the locking portion is separated over at least part of its longitudinal extension from side walls of the cavity by at least one recess.

[0025] These and other objects, features and advantages of the present invention will become more apparent upon reading of the following detailed description of preferred embodiments and accompanying drawings. It should be understood that even though embodiments are separately described, single features thereof may be combined to additional embodiments.

FIG. 1 is a front view of a female housing according to a first embodiment of the invention,

FIG. 2 is a rear view of the female housing,

FIG. 3 is a perspective view partly in section of the female housing, FIG. 4 is a front view of a female terminal fitting,

FIG. 5 is a bottom view of the female terminal fitting,

FIG. 6 is a left side view of the female terminal fitting,

FIG. 7 is a side view in section (the female housing is shown by a section along A-A of FIG. 1 and the female terminal fitting is shown by a section along D-D of FIG. 4) showing a state before the female terminal fitting is inserted into the female housing with a retainer mounted at a partial locking position,

FIG. 8 is a side view in section (the female housing is shown by a section along B-B of FIG. 1 and the female terminal fitting is shown by a section along E-E of FIG. 4) showing the state before the female terminal fitting is inserted into the female housing with the retainer mounted at the partial locking position,

FIG. 9 is a plan view in section (the female housing is shown by a section along C-C of FIG. 1 and the female terminal fitting is shown by a plan view) showing the state before the female terminal fitting is inserted into the female housing with the retainer mounted at the partial locking position,

FIG. 10 is a side view in section (the female housing is shown by the section along A-A of FIG. 1 and the female terminal fitting is shown by the section along D-D of FIG. 4) showing an intermediate stage of insertion of the female terminal fitting into the female housing,

FIG. 11 is a side view in section (the female housing is shown by the section along A-A of FIG. 1 and the female terminal fitting is shown by the section along D-D of FIG. 4) showing a state where the female terminal fitting is inserted in the female housing,

FIG. 12 is a side view in section (the female housing is shown by the section along B-B of FIG. 1 and the female terminal fitting is shown by the section along E-E of FIG. 4) showing the state where the female terminal fitting is inserted in the female housing,

FIG. 13 is a plan view in section (the female housing is shown by the section along C-C of FIG. 1 and the female terminal fitting is shown by the plan view) showing the state where the female terminal fitting is inserted in the female housing,

FIG. 14 is a side view in section (the female housing is shown by the section along A-A of FIG. 1 and the female terminal fitting is shown by the section along D-D of FIG. 4) showing a state where the retainer is moved to a full locking position,

FIG. 15 is a side view in section (the female housing is shown by the section along A-A of FIG. 1 and the female terminal fitting is shown by the section along D-D of FIG. 4) showing a state where a locking portion is resiliently deformed by a disengagement jig,

FIG. 16 is a front view of a female housing according to a second embodiment of the invention,

FIG. 17 is a rear view of the female housing,

FIG. 18 is a perspective view partly in section of the female housing, FIG. 19 is a front view of a female terminal fitting,

FIG. 20 is a bottom view of the female terminal fitting,

FIG. 21 is a left side view of the female terminal fitting,

FIG. 22 is a side view in section (the female housing is shown by a section along F-F of FIG. 16 and the female terminal fitting is shown by a section along H-H of FIG. 19) showing a state before the female terminal fitting is inserted into the female housing,

FIG. 23 is a plan view in section (the female housing is shown by a section along G-G of FIG. 16 and the female terminal fitting is shown by a plan view) showing the state before the female terminal fitting is inserted into the female housing,

FIG. 24 is a side view in section (the female housing is shown by the section along F-F of FIG. 16 and the female terminal fitting is shown by the section along H-H of FIG. 19) showing a state where the female terminal fitting is inserted in the female housing,

FIG. 25 is a plan view in section (the female housing is shown by the section along G-G of FIG. 16 and the female terminal fitting is shown by the plan view) showing the state where the female terminal fitting is inserted in the female housing, and

FIG. 26 is a section of a prior art connector.

[0026] Hereinafter, preferred embodiments of the present invention are described with reference to the accompanying drawings.

<First Embodiment>

[0027] A first preferred embodiment of the present invention is described with reference to FIGS. 1 to 15. In this embodiment is shown a female connector in which one or more female terminal fittings 10 are at least partly inserted in a female connector housing 40 (hereinafter, merely "female housing 40"). While being at least partly accommodated in the female housing 40, the female terminal fittings 10 are electrically connectable with male terminal fittings at least partly accommodated in a mating male housing (neither male terminal fittings nor male housing is shown) to be connected with the female housing 40. In the following description, directions IWD of inserting and withdrawing the female terminal fittings 10 into and from the female housing 40 are referred to as a forward direction and a backward direction, respectively, and reference is made to FIG. 7 concerning vertical direction.

[0028] The female terminal fitting 10 is formed into a desired shape by, for example, embossing, folding and/or bending a metallic base material stamped or cut out into a specified (predetermined or predeterminable) shape. This female terminal fitting 10 is, as shown in FIGS. 4 and 5, roughly constructed such that a main portion 11 substantially in the form of a box having open front and rear ends and a barrel portion 12 to be crimped or bent or folded into connection with an end of a wire W are connected one after the other. The barrel portion 12 is comprised of two front and rear pairs of crimping pieces 12a, 12b, wherein the front pair of crimping pieces 12a are or can be crimped or bent or folded into connection with a core Wa of the wire W, and the rear pair of crimping pieces 12b are or can be crimped or bent or folded into connection with an insulated portion Wb of the wire W.

[0029] The main portion 11 is comprised of a ceiling wall 13 extending in forward and backward or longitudinal directions, a pair of side walls 14, 15 extending down from the opposite lateral edges or edge portions of the ceiling wall 13, a bottom wall 16 projecting from the projecting end of the left side wall 14 of FIG. 4 to face the ceiling wall 13, and an outer wall 17 projecting from the projecting end of the right side wall 14 of FIG. 4 to be at least partly placed below or outside of the bottom wall 16.

[0030] The front end of the ceiling wall 13 is located at a position retracted backward as compared to those of the other walls 14, 15, 16 and 17, and a resilient contact piece 18 projects from this front end as shown in FIG 7. The resilient contact piece 18 preferably is supported only at one end and has a substantially triangular or bent or pointed shape by folding a tongue piece projecting forward from the front end of the ceiling wall 13. The resilient contact piece 18 can be resiliently brought into contact with a tab of a mating male terminal fitting at least partly inserted into the main portion 11 from front. A receiving portion 19 projects inward from the bottom wall 16 substantially facing or corresponding to the resilient contact piece 18. The receiving portion 19 can hold the tab while squeezing it in cooperation with the resilient contact piece 18 (or the tab can be arranged between the receiving portion 19 and the resilient contact piece 18). Further, a portion of the ceiling wall 13 is embossed to project inward, thereby forming an excessive deformation preventing projection or portion 20 for preventing an excessive resilient deformation of the resilient contact piece 18 by being engaged or engageable with the resilient contact piece 18 before the resilient contact piece 18 is resiliently deformed beyond its resiliency limit.

[0031] As shown in FIGS. 5 and 7, the outer wall 17 is divided into a front portion 17a and a rear portion 17b by a cut-away portion 21 preferably formed over the substantially entire width substantially substantially at its longitudinal middle portion. When the female terminal fitting 10 is at least partly inserted into the cavity 41, the locking portion 43 can at least partly enter this cut-away portion 21 and can be engaged with a front cut end surface 21a of the cut-away portion 21. The front cut end surface 21a of the cut-away portion 21 which surface serves as a locking surface engageable with the locking portion 43 is inclined inwardly or upward to the back preferably over its substantially entire area. In other words, the front cut end surface 21a overhangs or is back-tapered or is undercut. This cut-away portion 21 has a length slightly shorter than half the length of the outer wall 17 and extends up to the bottom end of the side wall 15 at the upper side in FIG. 5. A bulging piece 22 projecting from the projecting end of the bottom wall 16 is brought or bringable into contact with the bottom end surface (cut end surface of the cut-away portion 21 at the side) of this side wall 15 to hold the bottom wall 16 substantially horizontally. At a front half portion of the bottom wall 16 including the receiving portion 19, a recess 23 is so formed as to be slightly lower than a rear half portion thereof preferably over an substantially entire area except a contact portion of the bulging piece 22 with the side wall 15, thereby increasing a depth of engagement with the locking portion 43. The front portion 17a of the outer wall 17 is slightly shorter than the rear portion 17b in forward and backward or longitudinal directions.

[0032] As shown in FIG. 6, a rear-portion holding piece or portion 24 bent toward the ceiling wall 13 (inward direction) and the stabilizer 25 bent in an opposite direction (outward direction) are provided one after the other at the projecting end of the rear portion 17b of the outer wall 17. The rear-portion holding piece 24 holds the rear portion 17b while preventing the rear portion 17b from making loose forward and backward movements (or movements along the longitudinal direction of the terminal fitting 10) by being fitted into a rear-portion holding groove or recess 26 formed in the side wall 14 shown in FIG. 6. The stabilizer 25 can guide the insertion of the female terminal fitting 10 by being at least partly inserted along the stabilizer-inserting groove 48 in the cavity 41. The front end of the rear-portion holding piece 24 and the front end of the rear portion 17b are substantially aligned with each other, whereas the rear end of the stabilizer 25 and the rear end of the rear portion 17b are substantially aligned with each other. A widthwise center portion of the rear end of the rear portion 17b is embossed to project outward, thereby forming a projection 27 preferably having a length substantially equal to that of the stabilizer 25. This projection 27 can be brought into contact with the bottom surface of the cavity 41 (upper surface of the projection-inserting groove 47) when the female terminal fitting 10 is inserted into the cavity 41. A retainer 52 to be mounted into the female housing 40 is engageable with a stepped portion 28 (rear end surfaces of the bottom wall 16 and the rear portion 17b of the outer wall 17) at the rear bottom end of the main portion 11 including this projection 27.

[0033] At a substantially widthwise center (precisely speaking, position slightly displaced to the left side of FIG. 4 from the center) of the rear end (front cut end of the cut-away portion 21) of the front portion 17a of the outer wall 17 is embossed to project outward, thereby forming a locking projection 29 engageable with the locking portion 43. The locking projection 29 is, as shown in FIGS. 5 and 6, substantially in the form of a pyramid having a vertex at its front end and is tapered toward its front end so that the width and height thereof gradually decrease. The locking projection 29 is such that a pyramid portion 29a formed by three or more slanted surfaces and a substantially rectangular or parallelepipedic tube portion 29b preferably substantially having constant width and height and formed by three or more side surfaces are connected one after the other. The pyramid portion 29a of the locking projection 29 is tapered and preferably has its front end slightly rounded, so that the locking projection 29 can be smoothly at least partly inserted along the projection-inserting groove 47 in the process of inserting the female terminal fitting 10 into the cavity 41. The rectangular tube portion 29b of the locking projection 29 is formed to overhang backward or to be undercut or back-tapered preferably substantially along the inclination of the front cut end surface 21a of the cut-away portion 21 and projects more backward than the front portion 17a of the outer wall 17.

[0034] This locking projection 29 projects up to the substantially same height as the projection 27, and at least partly is insertable into the projection-inserting groove 47 of the cavity 41 similar to the projection 27. The rear end surface of the locking projection 29 serving as a locking surface engageable with the locking portion 43 is formed by the front

cut end surface 21a of the cut-away portion 21 and is inclined inwardly or upward to the back or toward the cut-away portion 21. The rear end surfaces of the portions of the front portion 17a of the outer wall 17 at the opposite sides of the locking projection 29 are also formed by the front cut end surface 21a of the cut-away portion 21 inclined inwardly or upward to the back and is engageable with the locking portion 43 (see FIGS. 8 and 12).

[0035] As shown in FIG. 6, a front-portion holding piece or portion 30 bent toward the ceiling wall 13 is provided at the projecting end or end portion (end to be brought substantially into abutment against the side wall 14) of the front portion 17a of the outer wall 17. The front-portion holding piece 10 holds the front portion 17a while preventing the front portion 17a from making loose forward and backward or longitudinal movements by being fitted into a front-portion holding groove or recess 31 formed in the side wall 14 as shown in FIG. 6. This front-portion holding piece 30 projects more backward than the front portion 17a of the outer wall 17. The cut-away portion 21 extends into the base end of the front-portion holding piece 30, and the cut end surface 21a thereof is inclined inwardly or upward to the back as already described. A side end of the locking portion 43 is engageable with this cut end surface 21a.

[0036] The female housing 40 is molded e.g. of a synthetic resin, and a plurality of cavities 41 into which the female terminal fittings 10 are at least partly insertable, preferably from behind, are arranged substantially side by side along widthwise direction at one or more, e.g. two stages as shown in FIGS. 1, 2 and 7. The female terminal fitting 10 at least partly inserted into the cavity 41 can be resiliently locked by the locking portion 43 (to be described in detail later) provided at a bottom or lateral wall 42 of the cavity 41, and is preferably supported at its front limit position by a front wall 44 of the female housing 40. The front wall 44 of the female housing 40 is formed with tab insertion holes 45 for permitting the tabs of the mating male terminal fittings to be at least partly inserted into the cavities 41 from front, and conical or tapered or converging guide surfaces 46 are formed at the front edges of the tab insertion holes 45 preferably over the substantially entire circumference, so that the insertion of the tabs can be smoothly guided.

[0037] The projection-inserting groove 47 along which the locking projection 29 and the projection 27 of the female terminal fitting 10 are at least partly insertable and the stabilizer-inserting groove 48 along which the stabilizer 25 is at least partly insertable are so formed in the bottom wall 42 of the cavity 41 as to have open rear ends or ends towards the inserting side. The projection-inserting groove 47 is formed substantially in the widthwise center of the cavity 41, whereas the stabilizer-inserting groove 48 is formed at the right side of the projection-inserting groove 47 in FIG. 2. The projection-inserting groove 47 is formed to be substantially continuous with the locking portion 43 as described below, whereas the front end position of the stabilizer-inserting groove 48 is set at a position slightly behind the locking portion 43.

[0038] A jutting or projecting portion 49 gradually jutting or projecting out inwardly (toward the locking portion 43) preferably over the substantially entire width is provided at the front end of the upper surface (surface facing the locking portion 43) of the cavity 41. The front end of the female terminal fitting 10 at least partly inserted into the cavity 41 is pushed toward the locking portion 43 by this jutting portion 49 to increase a depth of engagement with the locking portion 43. The peripheral edge of the rear end of the cavity 41 is inclined inwardly to the front substantially over the entire circumference except only a part so as to guide the female terminal fitting 10 (see FIG. 2). A restricting portion 50 which is an end surface extending in a direction at an angle different from 0° or 180°, preferably substantially normal to the inserting and withdrawing directions IWD of the female terminal fitting 10 is provided at an up-per-left position of the peripheral edge of the rear end of the cavity 41 in FIG. 2. This restricting portion 50 is brought or bringable into contact with the stabilizer 25 when the female terminal fitting 10 is improperly inserted upside down into the cavity 41, thereby hindering the insertion of the stabilizer 25. Further, the substantially front half of the cavity 41 is narrower than the substantially rear half thereof as shown in FIG. 9.

[0039] A retainer mount hole 51 into which a retainer 52 for doubly locking the female terminal fittings 10 is preferably mountable from a lateral direction, e.g. from below, is formed in the bottom wall of the female housing 40 as shown in FIG. 7. This retainer mount hole 51 is formed at such a position as to laterally expose longitudinal middle portions (portions slightly behind the locking portions 43) of the respective cavities 41 e.g. to outside below. The retainer 52 includes fastening portions 53 arrayed at one or more, e.g. two stages so as to substantially correspond to the respective cavities 41, and is vertically movable between two positions in the female housing 40: a partial locking or first position (see FIG. 7) where the respective fastening portions 53 are retracted laterally, e.g. downward, from the corresponding cavities 41 to permit the insertion and withdrawal of the female terminal fittings 10 into and from the cavities 41 and a full locking or second position (see FIG. 14) where the respective fastening portions 53 enter the corresponding cavities 41 to lock the female terminal fittings 10. This retainer 52 can be selectively held at the partial locking position and the full locking position by an unillustrated holding means. The retainer 52 is not shown in FIGS. 9 and 13.

[0040] Here, the construction of the locking portion 43 is described in detail. As shown in FIGS. 3 and 7, the locking portion 43 is provided at the front part (part before or near or adjacent to the retainer mount hole 51) of the bottom wall 42 of the cavity 41 and has an arm 54 supported at both front and rear ends. A fastening projection 55 which can at least partly enter the cut-away portion 21 of the female terminal fitting 10 to engage the front cut end surface 21a at least partly projects into the cavity 41 from the upper surface of the arm 54. The locking portion 43 preferably is substantially transversely symmetrical when viewed from front.

[0041] The arm 54 has its opposite bottom ends chamfered or beveled in a laterally long or elongated rectangular front view (see FIG. 1) and has a width substantially equal to that of the cavity 41 (precisely speaking, slightly smaller than the width of the cavity 41) (see FIG. 9). The arm 54 is resiliently deformable in a deformation direction DD, preferably substantially along vertical direction, with the front and rear supported portions as supporting points and is in a substantially arch or bridge-like shape in which a longitudinal middle portion thereof is located at a bottommost position (see FIG. 10) during the deformation. A deformation permitting space for permitting the resilient deformation of the arm 54 is so provided in the deformation direction DD, e.g. below, the arm 54 as to have a specified height. At positions spaced downward from the opposite side portions (chamfered portions) of the arm 54 by the height of the deformation permitting space, a pair of excessive deformation preventing rail portions 56 preferably having a substantially triangular cross section are provided along the longitudinal direction of the locking portion 43. The excessive deformation preventing rail portions 56 can prevent an excessive resilient deformation of the locking portion 43 by substantially engaging the locking portion 43 before the locking portion 43 is resiliently deformed beyond its resiliency limit or damaged. A rear portion 54b of the arm 54 is connected with the bottom wall 42 preferably over the substantially entire width and sloped upward toward the front, whereas a front portion 54a thereof is partly connected with the front wall 44 of the female housing 40 and is substantially horizontal. The projection-inserting groove 47 formed in the bottom wall 42 is continuously formed in the rear portion 54b, and parts of the rear portion 54b left at the opposite sides of the projection-inserting groove 47 serve as rear supporting portions 57 for supporting the female terminal fitting 10 laterally or from below.

[0042] The fastening projection 55 preferably has a width equal to the entire width of the arm 54 (see FIG. 9), the front end position thereof is substantially aligned with that of the rear portion 54b of the arm 54, and the rear surface thereof is so inclined as to be continuous with the rear portion 54b. The front surface of the fastening portion 55 serves as a locking surface 58 engageable with the female terminal fitting 10 and extends in a direction at an angle different from 0° or 180°, preferably substantially normal to forward and backward or longitudinal directions (inserting and withdrawing directions IWD of the female terminal fitting 10). The projection-inserting groove 47 formed in the rear portion 54b of the arm 54 is continuously formed in this fastening projection 55. Thus, the fastening projection 55 is recessed in its widthwise middle portion when viewed from front (see FIG. 1).

[0043] A maneuverable groove 59 which is open forward and into which a disengagement jig J (see FIG. 15) for forcibly resiliently deforming the locking portion 43 is at least partly insertable from outside at front is formed in the widthwise center of the upper surface of the front portion 54a of the arm 54 preferably over the substantially entire length, and parts of the front portion 54b left at the opposite sides of the maneuverable groove 59 serve as front supporting portions 60 for supporting the female terminal fitting 10 laterally or from below. In other words, the front portion 54a of the arm 54 is made thinner or to have a smaller thickness than the rear portion 54b by the presence of the maneuverable groove 59. The maneuverable groove 59 is formed to preferably have a depth slightly over half the thickness of the front portion 54a of the arm portion 54, and the opposite side surfaces thereof are curved surfaces inclined upward to the opposite outer sides so as to substantially conform to the outer shape of the arm 54 (see FIG. 1). The locking projection 29 of the female terminal fitting 10 at least partly inserted into the cavity 41 can enter this maneuverable groove 59, and an extended locking surface 61 substantially continuous with the locking surface 58 of the fastening projection 55 and engageable with the locking projection 29 is formed at the rear end of the maneuverable groove 59 (see FIG. 7). This extended locking surface 61 is inclined more backward than the locking surface 58 toward its bottom end (inclined along the front cut end surface 21a of the cut-away portion 21 of the female terminal fitting 10).

[0044] At the front half of the front portion 54a of the arm 54, a jig-introducing groove 62 for permitting the introduction of the disengagement jig J is formed to communicate with the maneuverable groove 59. This jig-introducing groove 62 is so formed as to fork or split the front half of the front portion 54a of the arm 54. A guide surface 63 inclined upward to the back for guiding the disengagement jig J into the maneuverable groove 59 is formed at the rear end of the jig-introducing groove 62. It should be noted that the maneuverable groove 59 and the jig-introducing groove 62 form part of an opening 64 to be described next.

[0045] The openings 64 are so formed below the tab insertion holes 45 in the front wall 44 of the female housing 40 as to be open forward as shown in FIG. 1 by removing a mold for forming the front surface contour (including the locking surface 58 and the extended locking surface 61) and the side surface contours (opposite side surfaces at the bottom part of the arm 54) of the locking portion 43 forward. Since each opening 64 has a height equal to the substantially entire height of the locking portion 43, it slightly cuts out the bottom end of the guide surface 46. However, a projecting portion 65 projects downward from an upper surface 64a of the opening 64 along the outer shape of the fastening projection 55, and the guide surface 46 is continuously extended to this projecting portion 65. Mold-removal grooves 66, 67 are formed in a portion of the female housing 40 behind the front wall 44 as shown in FIG. 2 by removing a mold for forming the rear surface contour (including the rear surfaces of connected portions 70, 71) and the side surface contours (opposite side surface of the upper part of the arm 54 and the fastening portion 55), and communicate with the cavity 41 at the opposite side positions of the locking portion 43 and are open backward. The opposite bottom ends of the rear half of the cavity 41 are cut out by these mold-removal grooves 66, 67.

[0046] A pair of branched portions 68, 69 of the front portion 54a of the arm 54 divided into left and right portions by the jig-introducing groove 62 are connected with side surfaces 64b, 64c (side surfaces extending along the deforming direction of the locking portion 43) of the opening 64 as shown in FIG. 1. The connected portions 70, 71 with the branched portions 68, 69 are displaced or spaced apart sideways or in a widthwise direction (direction intersecting with the deforming direction DD of the locking portion 43) from the arm 54. Specifically, since both connected portions 70, 71 are located at such positions as not to hinder the formation of the fastening projection 55 and the locking surface 58 in an area extending over the substantially entire width of the arm 54, the widths of the fastening projection 55 and the locking surface 58 are set equal to the substantially entire width of the locking portion 43. Further, the branch portions 68, 69 and the locking surface 58 are located at positions adjacent to each other along vertical direction.

[0047] Next, the functions of this embodiment constructed as above are described. As shown in FIGS. 7 to 9, after the retainer 52 is mounted at the partial locking position (first position) in the female housing 40, the female terminal fitting 10 is at least partly inserted into the cavity 41 preferably from behind with the barrel portion 12 of the female terminal fitting 10 crimped or bent or folded into connection with the wire W. At this time, if an attempt is made to insert the female terminal fitting 10 upside down by being turned from a proper inserting posture where the stabilizer 25 substantially faces down, the front end surface of the upward-facing stabilizer 25 comes into contact with the restricting portion 50 formed at the peripheral edge of the rear end of the cavity 41, thereby hindering the insertion of the female terminal fitting 10. In this way, an upside-down insertion of the female terminal fitting 10 can be securely prevented.

[0048] When the female terminal fitting 10 is at least partly inserted into the cavity 41 while being properly oriented, the locking projection 29 is first at least partly introduced into the projection-inserting groove 47 and then the projection 27 and the stabilizer 25 are introduced into the projection-inserting groove 47 and the stabilizer-inserting groove 48, respectively, whereby the female terminal fitting 10 can be smoothly inserted while being prevented from shaking along vertical and transverse directions. When the female terminal fitting 10 is inserted to a specified depth, the locking portion 43 is pressed by the locking projection 29, whereby the arm 54 is resiliently deformed in the deformation direction DD, e.g. downward, as shown in FIG. 10. At this time, the arm 54 is deformed into a shallow V-shape (or hanging shape) as a whole when viewed sideways, wherein the front portion 54a is inclined backward while the rear portion 54b is inclined forward. During this process, the locking projection 29 can be smoothly inserted along the projection-inserting groove 47 and can smoothly press the locking portion 43 by being preferably formed into a substantially pyramidal shape having a vertex at the front end.

[0049] There are cases where an operator misjudges that the female terminal fitting 10 has reached a proper depth although it is still insufficiently inserted and tries to move the retainer 52 to the full locking position (second position). In such a case, the fastening portion 53 of the retainer 52 comes into contact with the bottom surface of the main portion 11 of the female terminal fitting 10, thereby preventing the movement of the retainer 52 to the full locking position. Thus, the insufficient or improper insertion of the female terminal fitting 10 can be detected.

[0050] When the female terminal fitting 10 is inserted to the proper depth in the cavity 41, the locking projection 29 enters the maneuverable groove 59 located before the fastening projection 55 of the locking portion 43 after moving beyond this fastening projection 55 as shown in FIGS. 11 to 13, whereupon the locking portion 43 is at least partly resiliently restored. Then, the fastening projection 55 of the locking portion 43 enters the cut-away portion 21 and the locking surface 58 and preferably the extended locking surface 61 are substantially engaged with the front cut end surface 21a (including the rear end surface of the locking projection 29) of the cut-away portion 21. In this way, the female terminal fitting 10 is held by the locking portion 43 so as not to come out. In the process of properly inserting the female terminal fitting 10, a depth of engagement of the locking portion 43 with the female terminal fitting 10 is increased since the front end of the main portion 11 is pushed down (or toward the locking projection 43) by the jutting portion 49 on the ceiling surface of the cavity 41 to be thereby displaced toward the locking portion 43. The locking surface 58 of the locking portion 43 is formed in a width range equal to the entire width of the locking portion 43, i.e. the width of the cavity 41, and the front cut end surface 21a of the cut-away portion 21 of the female terminal fitting 10 is extended to the front portion 17a of the outer wall 17 including the locking projection 29 and the front-portion holding piece 30, i.e. in a width range extending over the substantially entire width of the female terminal fitting 10. Thus, the female terminal fitting 10 is held so as not to come out of the cavity 41 by a strong locking force. Further, since the front cut end surface 21a of the cut-away portion 21 is inclined inwardly or upward to the back or toward the locking portion 43 and the extended locking surface 61 is so inclined as to substantially conform to the front cut end surface 21a, the locking force is stronger.

[0051] When the retainer 52 is moved to the full locking position (second position) as shown in FIG. 14 after all the female terminal fittings 10 are properly inserted into the corresponding cavities 41, the respective fastening portions 53 enter the corresponding cavities 41 to engage the stepped portions 28 including the projections 27. In this way, the female terminal fittings 10 are preferably doubly locked in the cavities 41 by the locking portions 43 and the retainer 52.

[0052] On the other hand, the terminal fitting 10 may be withdrawn from the female housing 40 for maintenance or other reason. In such a case, after the retainer 52 is first returned from the full locking position (second position) to the partial locking position (first position) as shown in FIG. 11, the locking portion 43 is forcibly resiliently deformed by the

disengagement jig J. In order to resiliently deform the locking portion 43, the disengagement jig J is inserted into the jig-introducing groove 62 and the maneuverable groove 59. At this time, an initial inserting operation can be easily performed since a wide entrance for the disengagement jig J is provided by the jig-introducing groove 62. Further, since the rear end surface of the jig-introducing groove 62 is formed into the guide surface 63 inclined toward the maneuverable groove 59, the disengagement jig J can be smoothly guided to the maneuverable groove 59. By inclining or moving the disengagement jig J along the inclination of the outer surface of the locking projection 29 while inserting the disengagement jig J to the back of the maneuverable groove 59, the wall surface of the maneuverable groove 59 is pushed down to forcibly resiliently deform the arm 54 by the leading end of the disengagement jig J. Then, the locking portion 43 is disengaged from the female terminal fitting 10. Therefore, the female terminal fitting 10 can be pulled out of the cavity 41 e.g. if the wire W is gripped and pulled.

[0053] As described above, according to this embodiment, the locking portion 43 is supported at both ends. Thus, as compared to the conventional locking portion supported only at one end, the locking portion 43 is allowed to have a higher strength even if being thinned and, accordingly, a force to lock the female terminal fitting 10 can be enhanced. Therefore, the female connector suited to being miniaturized can be provided.

[0054] Further, since the branched portions 68, 69 of the front portion 54a of the arm 54 projecting more forward than the locking surface 58 of the locking portion 43 are connected with the side surfaces 64b, 64c of the opening 64 preferably extending substantially along the deforming direction DD of the locking portion 43, the connected portions 70, 71 do not stand as a hindrance in forming the locking surface 58 or laterally spaced away and, accordingly, the locking surface 58 can be formed wide in such a range as to be adjacent to the branched portions 68, 69 substantially along the deforming direction DD of the locking portion 43. Therefore, sufficient locking forces can be secured for the female terminal fittings 10 even if the female connector is miniaturized and, as a result, the female connector suited to being miniaturized can be provided.

[0055] Furthermore, since the locking portion 43 is connected with the side surfaces 64b, 64c of the opening 64 facing each other, the locking surface 58 can have such a width equal to the substantially entire width of the locking portion 43 and can be engaged with the female terminal fitting 10 substantially over the entire width. Thus, the force to lock the female terminal fitting 10 can be more enhanced.

[0056] Further, since the locking projection 29 projecting from the female terminal fitting 10 can at least partly enter the maneuverable groove 59 formed in the locking portion 43 and the extended locking surface 61 is engageable with this locking projection 29, the force to lock the female terminal fitting 10 can be even more enhanced.

[0057] Accordingly, to provide a connector suited to being miniaturized, a female housing is provided with cavities 41 into which terminal fittings are at least partly insertable, and locking portions 43 provided in the cavities 41 and resiliently engageable with the terminal fittings being inserted to lock the terminal fittings. Openings 64 formed by removing a mold for forming locking surfaces 58 of the locking portions 43 engageable with the female terminals are so formed in the female housing as to be open forward. Each locking portion 43 is supported at both front and rear ends, and a section thereof projecting more forward than the locking surface 58 is connected with one or more side surfaces 64b, 64c (of the circumferential or opening surfaces) of the corresponding opening 64 extending along a deforming direction DD of the locking portion 43.

<Second Embodiment>

[0058] A second preferred embodiment of the present invention is described with reference to FIGS. 16 to 25. In the second embodiment, the shapes of a locking portion 43A and the like are changed according to a change in the shape of a female terminal fitting 10A. It should be noted that the construction and functions different from those of the first embodiment are described and repetitive description on the same or similar construction as in the first embodiment is avoided as much as possible in the second embodiment.

[0059] First, the female terminal fitting 10A is described. In a main portion 11A, a cut-away portion 21A is so formed as to leave a projecting end portion of an outer wall 17A over the entire length as shown in FIG. 20. In other words, the projecting ends of a front portion 17aA and a rear portion 17bA of the outer wall 17A are coupled or connected by a reinforcing piece 32 extending in forward and backward or longitudinal directions. In other words, the width of the cut-away portion 21A according to this embodiment is smaller than that of the cut-away portion 21 of the first embodiment. Thus, as compared to the female terminal fitting in which the outer wall 17A is divided into the front and rear portions by the cut-away portion 21 as in the first embodiment described above (see FIG. 5), the strengths of the front and rear portions 17aA, 17bA of the outer wall 17A can be stronger. Thus, even if a pulling force acts on the female terminal fitting 10A with the locking portion 43A engaged with the front portion 17aA of the outer wall 17A, the front portion 17aA of the outer wall 17A can be made difficult to undergo an opening deformation by being supported by the reinforcing piece 32.

[0060] As shown in FIGS. 20 and 21, a rear end part of the front portion 17aA of the outer wall 17A is embossed to project downward, thereby forming a locking projection 29A having a substantially triangular pyramidal shape having

its front end as a vertex, and the rear end of the locking projection 29A overhangs backward or is back-tapered or undercut. The rear portion 17bA of the outer wall 17A has its rear end cut out by a specified length, and a portion of a bottom wall 16A corresponding to this cut-out portion is embossed to project downward, thereby forming a projection 27A. A stepped portion 28A to be engaged with a retainer 52A is formed by this projection 27A. At the right side of the projection 27A in FIG. 19, a stabilizer 25A projects down from the rear end of the projecting end of a side wall 15A. The stabilizer 25A is provided at a position transversely reversed from the one of the first embodiment (see FIG. 4). As shown in FIGS. 19 and 22, the resilient contact piece 18A is supported only at one end and formed by folding a piece 33 projecting from a lateral edge of the rear end of a ceiling wall 13A to extend along the side wall 15A and the ceiling wall 13A, and extends forward along the ceiling wall 13A from the front end of the piece 33. The leading end of the piece 33 is at least partly inserted into a hole 34 formed in a side wall 14A to prevent forward and backward or longitudinal displacements of the resilient contact piece 18A. In this female terminal fitting 10A, the front-portion holding piece 30, the front-portion holding groove 31, the rear-portion holding piece 24, the rear-portion holding groove 26, the recess 23 and/or the excessive deformation preventing projection 20 shown in the first embodiment preferably are omitted.

[0061] Next, the female housing 40A is described. As shown in FIG. 16, the locking portion 43A is formed transversely asymmetrical (or asymmetrical in the widthwise direction) e.g. when viewed from front. Among a pair of branched portions 68A, 69A of a front portion 54aA of an arm 54A, the right branched portion 69A in FIG. 16 is connected with a right side surface 64cA of an opening 64A, whereas the left branched portion 68A is connected with an upper surface 64aA (surface of a cavity 41A extending in a direction at an angle different from 0° or 180°, preferably substantially normal to a deforming direction DD of the locking portion 43A) of the opening 64A. A connected portion 71A with the right branched portion 69A is located at a position displaced sideways (direction intersecting with the deforming direction DD of the locking portion 43A) from the arm 54A, whereas a connected portion 70A with the left branched portion 68A is located at a position displaced upward (toward a fastening projection 55A) from the arm 54A. Since a mold needs to be removed backward from the left connected portion 70A in order to form this connected portion 70A, the fastening projection 55A and a locking surface 58A cannot be formed in a range overlapping the connected portion 70A when viewed from front (behind), i.e. in such a range as to hinder the formation of the connected portion 70A. In other words, the formation range of the left connected portion 70A is restricted by the fastening projection 55A and the locking surface 58A. Accordingly, the left ends of the fastening projection 55A and the locking surface 58A overlapping the left connected portion 70A are cut out, and the widths thereof are smaller than that of the locking portion 43A by the width of the left connected portion 70A. Conversely speaking, escaping spaces 72 are defined at the right or lateral side of the fastening projections 55A by mold-removal holes 66A formed by removing the mold for forming the connected portions 70A and the like.

[0062] As shown in FIGS. 16 and 18, the rear portion 54bA of the arm 54A is sloped upward to the front at its widthwise center portion, and the opposite side portions thereof are formed to be parallel with the front portion 54aA. Since the side surface contour of the left branched portion 68A is formed by the mold removed forward, the opening 64A is formed in such a range as shown in FIG. 16. A front supporting portion 60A at the upper side of FIG. 23 is provided with a shake-preventing portion 73 sloped upward to the front as shown in FIG. 18. A front end portion of the female terminal fitting 10 is substantially closely fittable between a jutting portion 49A located above and the shake-preventing portion 73, whereby the female terminal fitting 10A is prevented from shaking. Further, a maneuverable groove 59A is formed to be narrower than that of the first embodiment (see FIG. 1) and to be arcuate as shown in FIG. 16. The upper surface of the arm 54A is located lower than that of the first embodiment (see FIG. 1), and the height of the fastening projection 55A is made larger accordingly. A stabilizer-inserting groove 48A is provided at the left end in FIG. 17 substantially in conformity with the shape of the female terminal fitting 10A, and a restricting portion 50A is provided at a right-upper position of the peripheral edge of the rear end of the cavity 41A in FIG. 17.

[0063] Next, the functions of this embodiment are described. When the female terminal fitting 10A is inserted to a proper depth in the cavity 41A, the locking projection 29A at least partly enters the maneuverable groove 59A and the fastening projection 55A of the locking portion 43A at least partly enters the cut-away portion 21A, whereby the locking surface 58A and preferably an extended locking surface 61A are engaged with a front cut end surface 21aA as shown in FIGS. 24 and 25. At this time, the reinforcing piece 32 coupling the front and rear portions 17aA, 17bA of the outer wall 17A is escaped into the escaping space 72 provided at the side of the fastening projection 55A. If the female terminal fitting 10A should be inserted into the female housing 40 shown in the first embodiment, the locking portion 43 cannot be restored because the fastening projection 55 of the locking portion 43 interferes with the reinforcing piece 32 (see FIG. 13). However, if the escaping space 72 is formed at the side of the fastening projection 55A as in this embodiment, the interference with the reinforcing piece 32 can be avoided and the locking portion 43A can be normally restored even if the female terminal fitting 10A in which the strength of the outer wall 17A is enhanced by the reinforcing piece 32 is inserted. In other words, the female terminal fitting 10A having a high strength even in spite of miniaturization can be used in the female housing 40A shown in this embodiment. Therefore, the female connector suited for being miniaturized can be provided.

<Other Embodiments>

[0064] The present invention is not limited to the above described and illustrated embodiments. For example, the following embodiments are also embraced by the technical scope of the present invention as defined by the claims. 5
Beside the following embodiments, various changes can be made without departing from the scope and spirit of the present invention as defined by the claims.

(1) Even if the female terminal fitting shown in the first embodiment is at least partly accommodated in the female housing shown in the second embodiment, the locking portion can be normally restored without interfering with the female terminal fitting. 10

(2) Although the front end portion of the locking portion is connected at two positions with the circumferential surfaces of the opening in the foregoing embodiments, it may be connected at one, three or more positions with the circumferential surfaces of the opening according to the present invention. In order to connect the front end portion of the locking portion at three or more positions with the circumferential surfaces of the opening, for example, 15
either one or both of the two branched portions 68, 69 connected with the side surfaces 64b, 64c may also be connected with the upper surface 64a of the opening 64.

(3) Although the front end portion of the locking portion is forked in the foregoing embodiments, it is not necessarily required to be forked according to the present invention.

(4) Although the side surfaces of the opening connected with the locking portion are straight along vertical direction or with respect to the deforming direction DD in the foregoing embodiments, they may be slightly inclined with respect to vertical direction or curved according to the present invention. 20

(5) Although the female terminal fitting is provided with the locking projection in the foregoing embodiments, connectors in which female terminal fittings having no locking projection are at least partly accommodated are also embraced by the present invention.

(6) Although the female connector in which the female terminal fittings are accommodated in the female housing is described in the foregoing embodiments, the present invention is also applicable to male connectors in which male terminal fittings are at least partly accommodated in a male housing. 25

LIST OF REFERENCE NUMERALS

[0065]

10, 10A	female terminal fitting
11, 11A	main portion
12	barrel portion
12a	crimping piece
12b	crimping piece
13, 13A	bottom wall
14, 14A, 15, 15A	side wall
16	ceiling wall
17, 17A	outer wall
17a, 17aA	front portion
17b, 17bA	rear portion
18, 18A	resilient contact piece
19	receiving portion
20	excessive deformation preventing portion
21	cut-away portion
21a	cut end surface
22	jutting piece
23	recess
24	rear-portion holding piece
25, 25A	stabilizer
26	rear-portion holding groove
27	projection
28, 28A	stepped portion
29, 29A	locking projection
29a	pyramidal portion
29b	rectangular tubular portion

	30	front-portion holding piece
	32	reinforcing piece
	33	piece
	34	hole40, 40A female housing (connector housing)
5	41	cavity
	42	bottom wall
	43, 43A	locking portion
	45	tab insertion opening
	47	projection-inserting groove
10	48, 48A	stabilizer-inserting groove
	49, 49A	bulging portion
	50, 50A	restricting portion
	51	retainer mount hole
	52, 52A	retainer
15	53	fastening portion
	54, 54A	arm
	54a, 54aA	front potion (section projecting from the locking surface)
	54b, 54bA	rear portion
	55, 55A	fastening projection
20	56	excessive deformation preventing rail
	58, 58A	locking surface
	59, 59A	maneuvering groove
	60, 60A	front supporting portion
	61, 61A	extended locking surface (extended portion)
25	62	jig-introducing groove
	63	guide surface
	64	opening
	64a, 64aA	upper (surface of the cavity substantially normal to the side surface)
	64b, 64bA, 64c, 64cA	side surface
30	65	projecting portion
	66, 66A, 67	mold-removal groove
	68, 68A, 69, 69A	branched portion
	70, 70A, 71, 71A	connecting portion
	72	escaping space
35	J	disengagement jig

Claims

- 40 1. A connector, comprising a connector housing (40; 40A), at least one cavity (41; 41A) into which a terminal fitting (10; 10A) is at least partly insertable, and a locking portion (43; 43A) provided in the cavity (41; 41A) and resiliently engageable with the terminal fitting (10; 10A) being at least partly inserted to lock the terminal fitting (10; 10A),
 45 wherein the connector housing (40; 40A) is formed with an opening (64; 64A) which is open forward,
 wherein the locking portion (43; 43A) comprises a locking surface (58; 58A; 61; 61A) for locking the terminal fitting (10; 10A) and is supported at both ends, and
 wherein a section (54a; 54aA) of the locking portion (43; 43A) projecting more forward than the locking surface (58; 58A; 61; 61A) is connected with at least one side surface (64c; 64b; 64aA; 64cA) of the opening (64; 64A).
- 50 2. A connector according to claim 1, wherein the side surface (64c; 64b; 64aA; 64cA) extends substantially along a deforming direction (DD) of the locking portion (43; 43A).
- 55 3. A connector according to one or more of the preceding claims, wherein the section (54a; 54aA) of the locking portion (54; 54A) projecting more forward than the locking surface (58; 58A; 61; 61A) is connected with a pair of side surfaces (64c, 64b; 64aA, 64cA) of the opening (64; 64A) which side surfaces (64c, 64b; 64aA, 64cA) preferably substantially face each other.
4. A connector according to one or more of the preceding claims, wherein the section (54a; 54aA) of the locking

portion (54; 54A) projecting more forward than the locking surface (58; 58A; 61; 61A) is connected with the side surface(s) (64c; 64b; 64aA; 64cA) of the opening (64; 64A) and with a surface (70A; 73) of the opening (64; 64A) or adjacent thereto substantially normal to the side surface(s) (64c; 64b; 64aA; 64cA) and located at the side of the cavity (41; 41A).

5. A connector according to one or more of the preceding claims, wherein the section (54a; 54aA) of the locking portion (54; 54A) projecting more forward than the locking surface (58; 58A; 61; 61A) is formed with a maneuverable groove (59; 59A) which is substantially open forward and is maneuverable by a disengagement jig (J) to forcibly resiliently deform the locking portion (54; 54A).
6. A connector according to claim 5, wherein the disengagement jig (J) can be inserted into the opening (64; 64A) for maneuvering the maneuverable groove (59; 59A).
7. A connector according to claim 5 or 6, wherein a locking projection (29; 29A) projecting from the terminal fitting (10; 10A) is insertable into the maneuverable groove (59; 59A), and the locking surface (58; 58A; 61; 61A) is extended preferably to the rear end of the maneuverable groove (59; 59A) so that the extended part (61; 61A) of the locking surface (58; 58A; 61; 61A) is engageable with the locking projection (29; 29A) for locking.
8. A connector according to claim 5, 6 or 7, wherein a jig-introducing groove (62) through which the disengagement jig (J) can be introduced is so formed at the section (54a; 54aA) of the locking portion (54; 54A) projecting more forward than the locking surface (58; 58A; 61; 61A) as to communicate with the maneuverable groove (59; 59A).
9. A connector according to claim 8, wherein jig-introducing groove (62) forks the section (54a; 54aA) of the locking portion (54; 54A) projecting more forward than the locking surface (58; 58A; 61; 61A).
10. A connector according to one or more of the preceding claims, wherein the locking portion (54; 54A) is separated over at least part of its longitudinal extension from side walls of the cavity (41; 41A) by at least one recess (66; 72).

FIG. 1

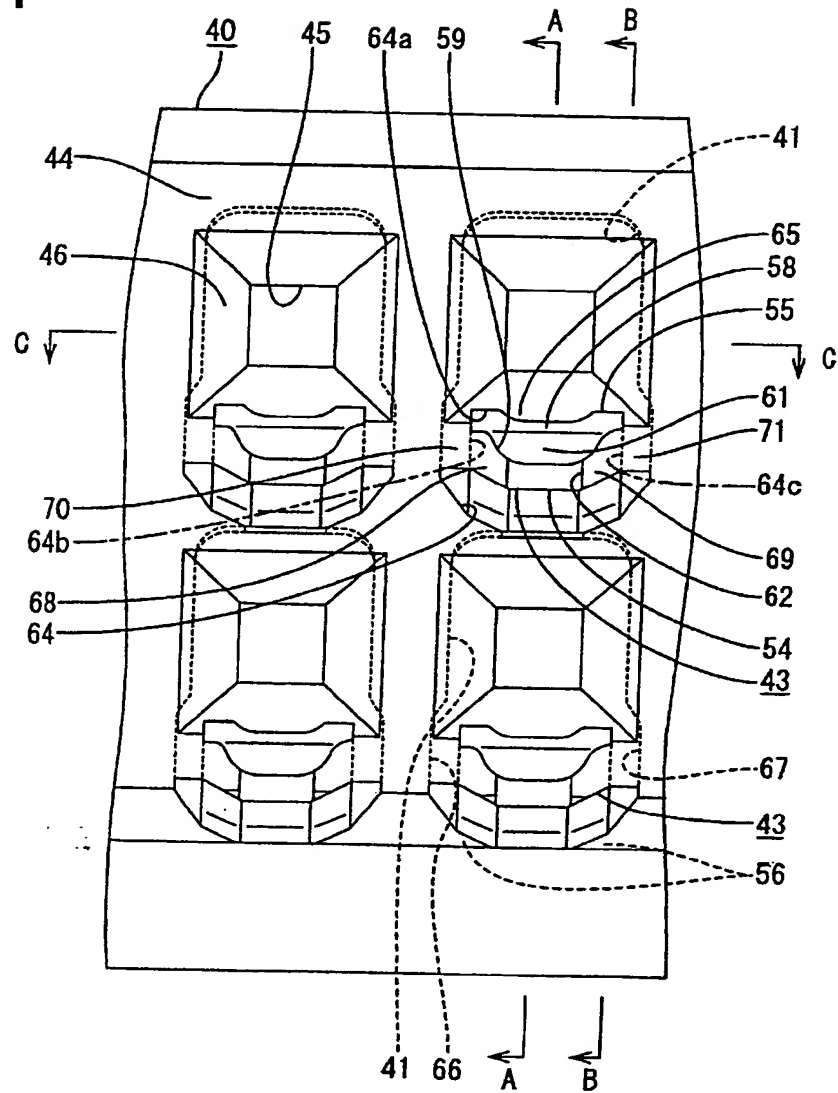


FIG. 2

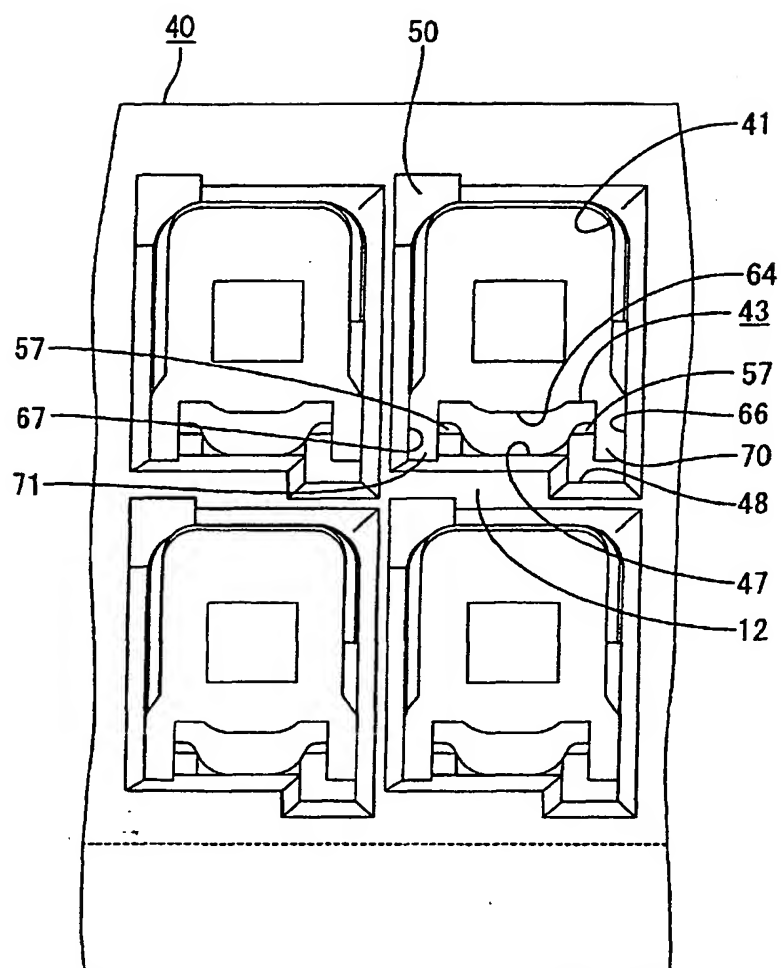


FIG. 3

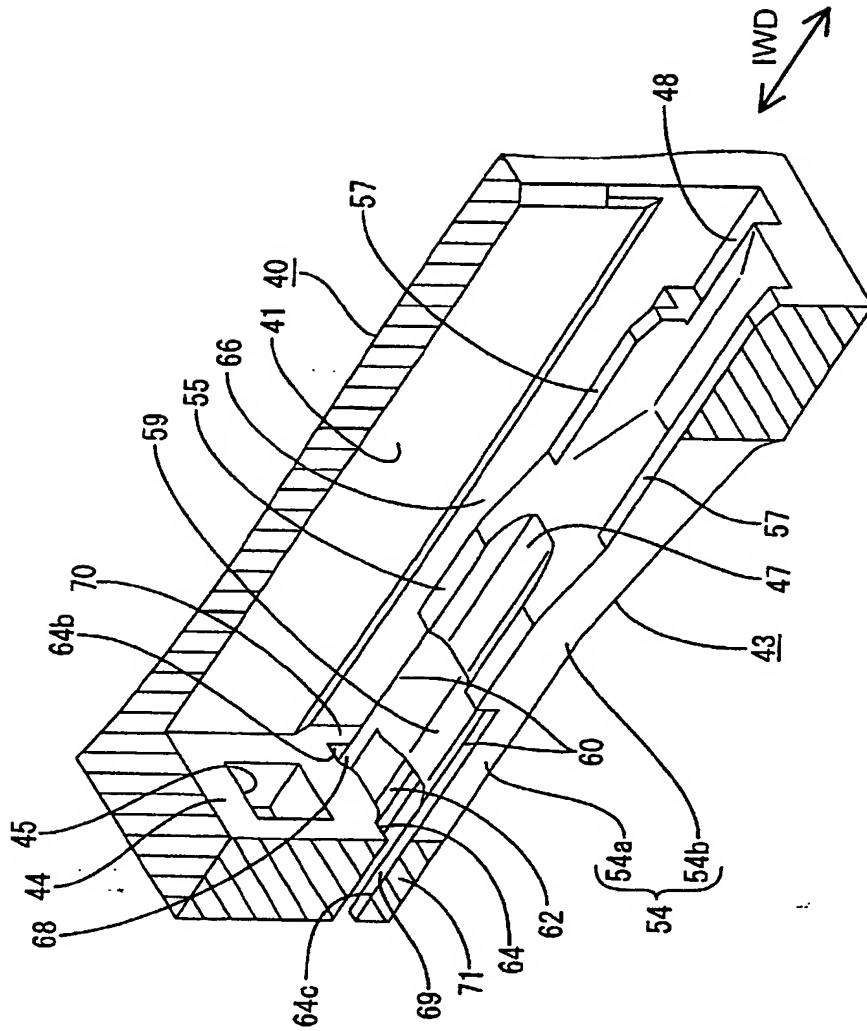


FIG. 4

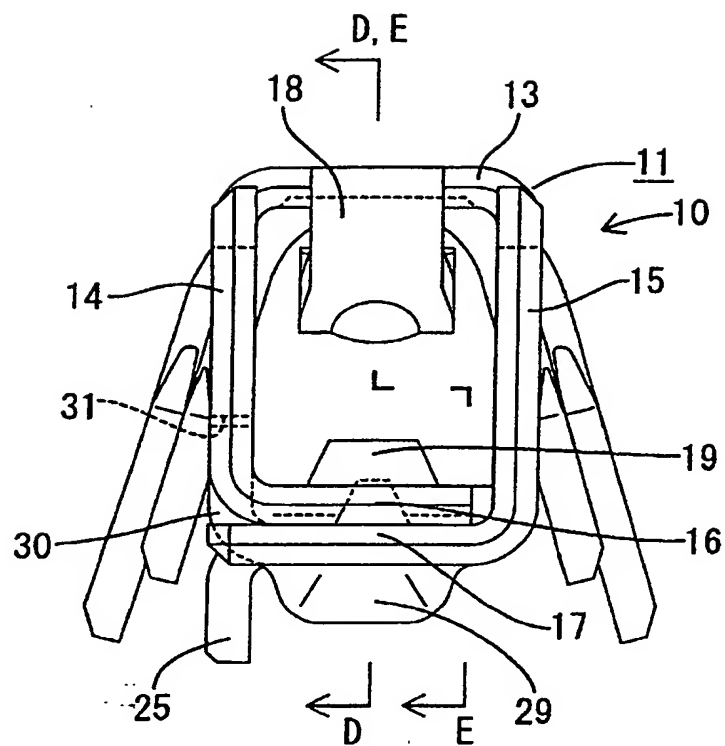


FIG. 5

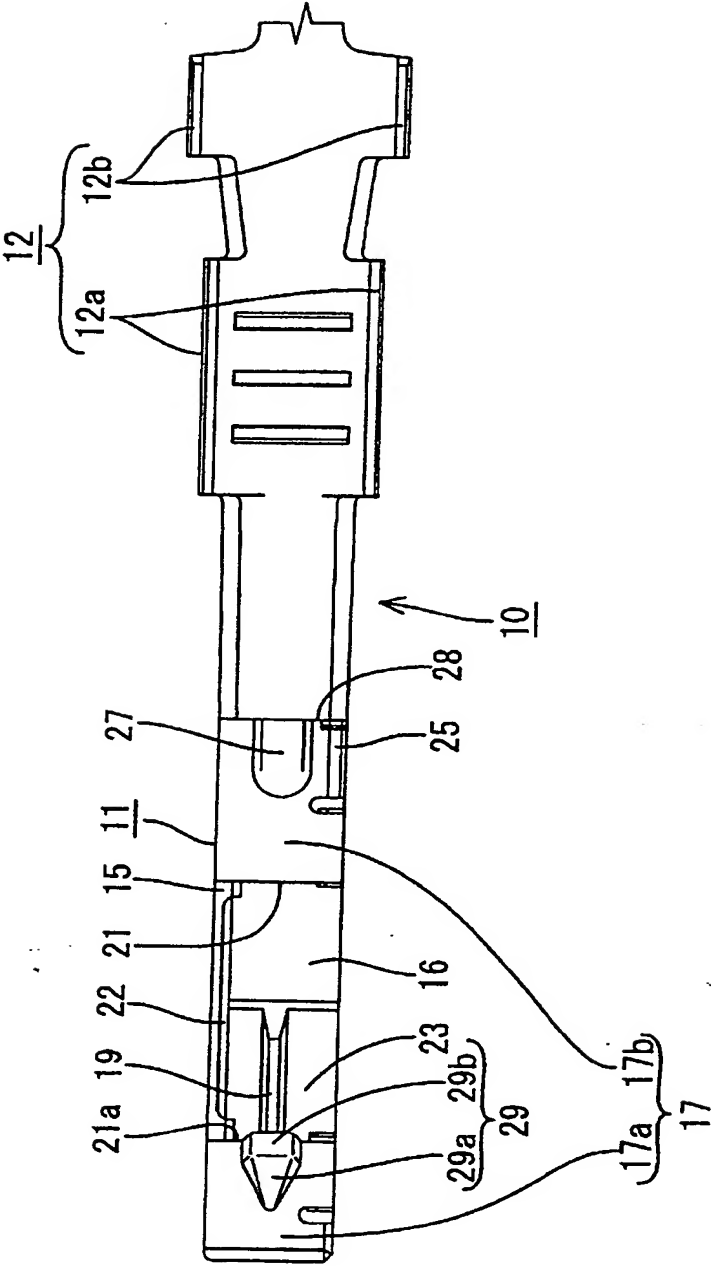


FIG. 6

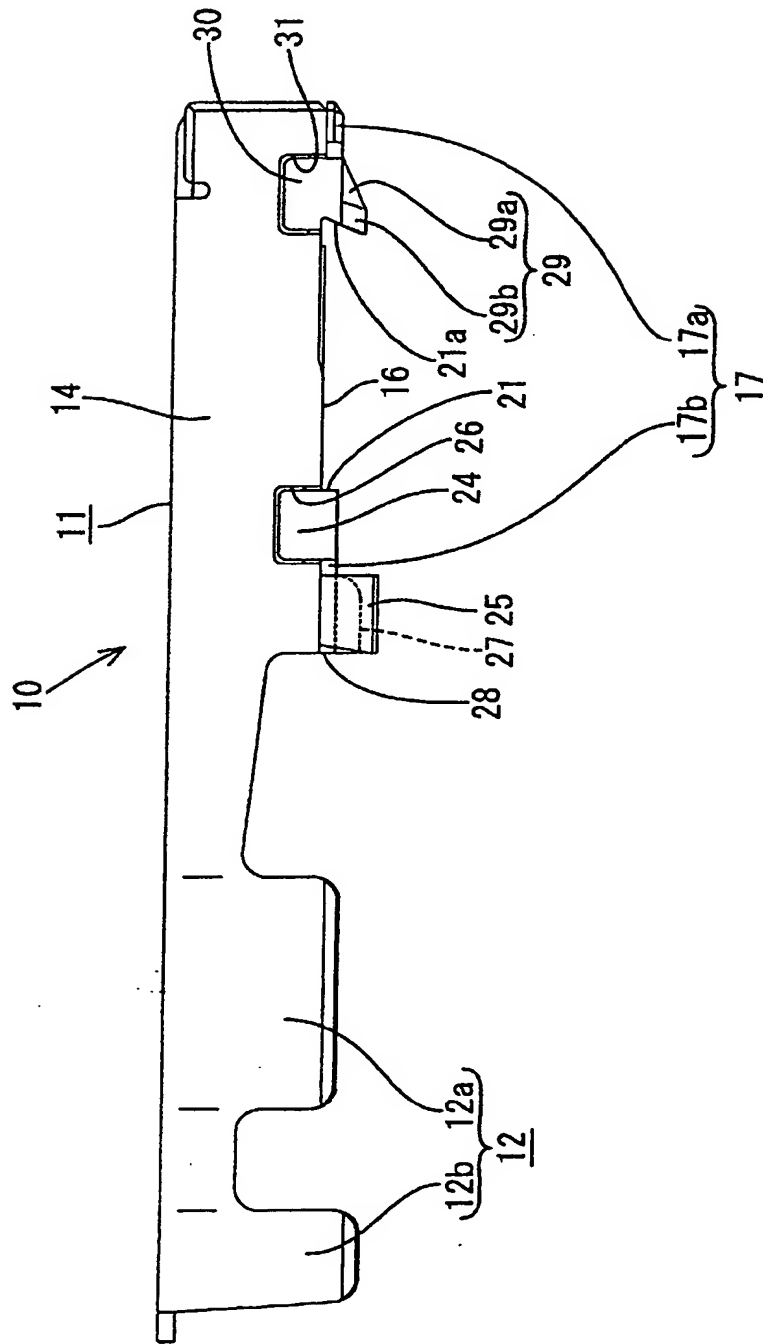
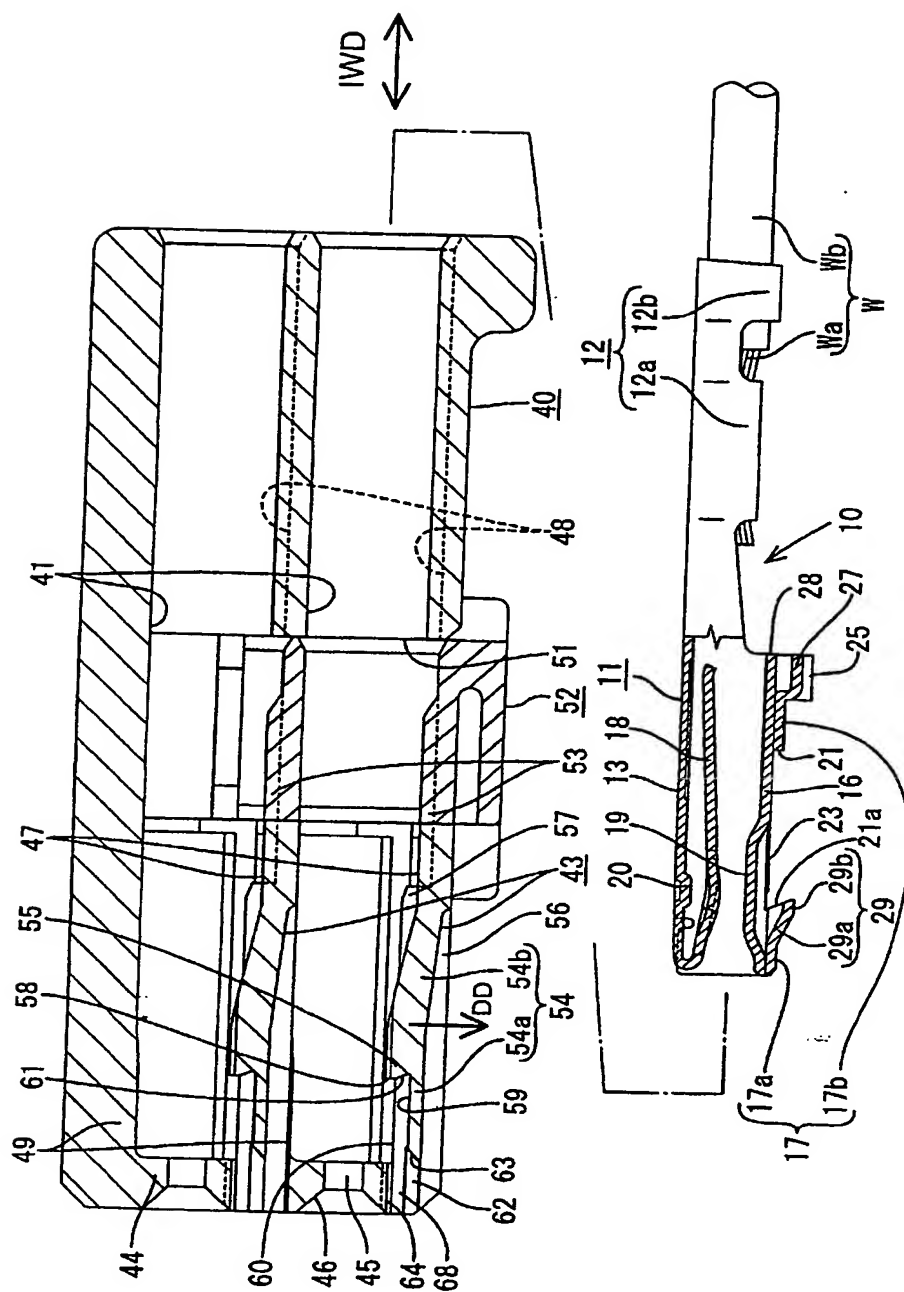


FIG. 7



FE³⁺

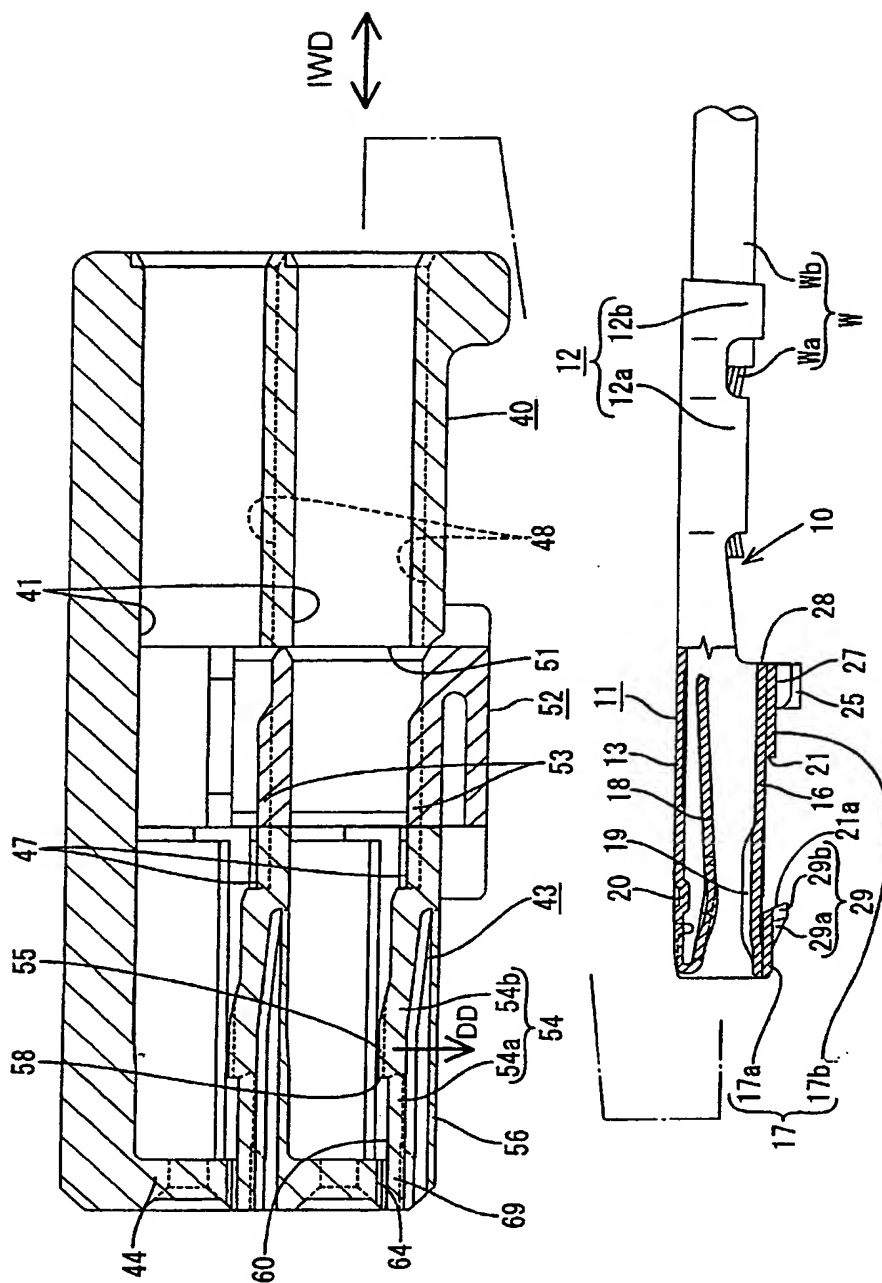


FIG. 9

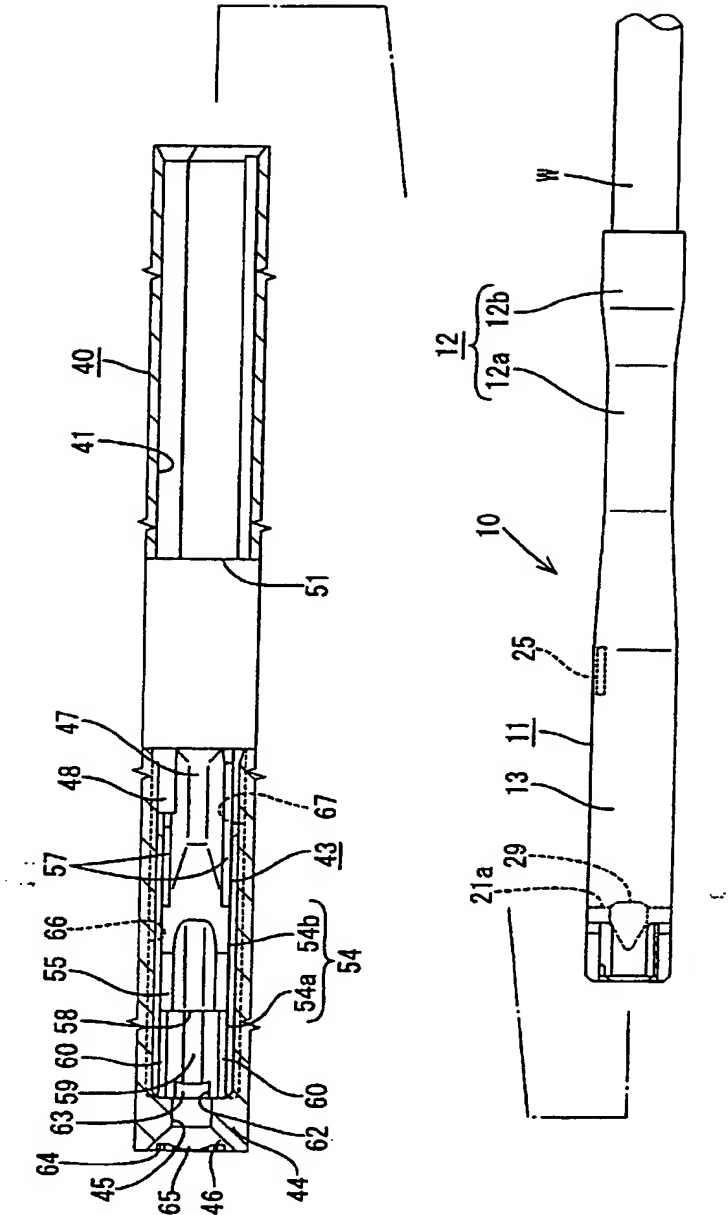


FIG. 10

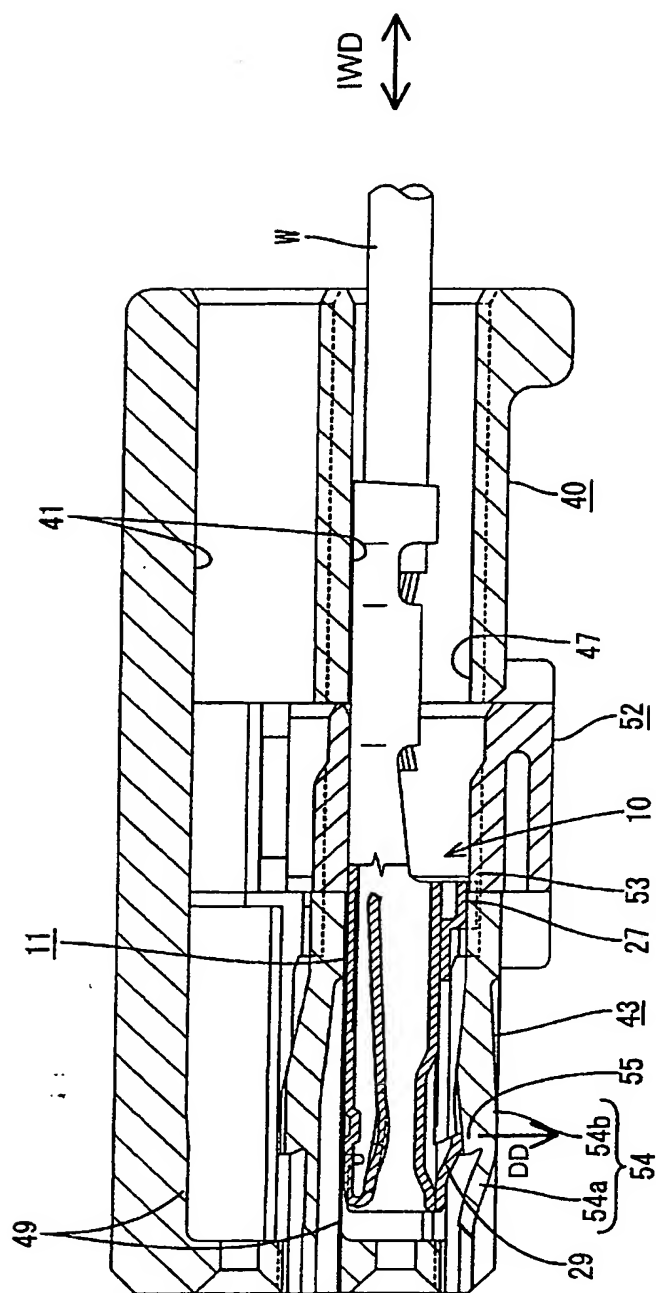


FIG. 11

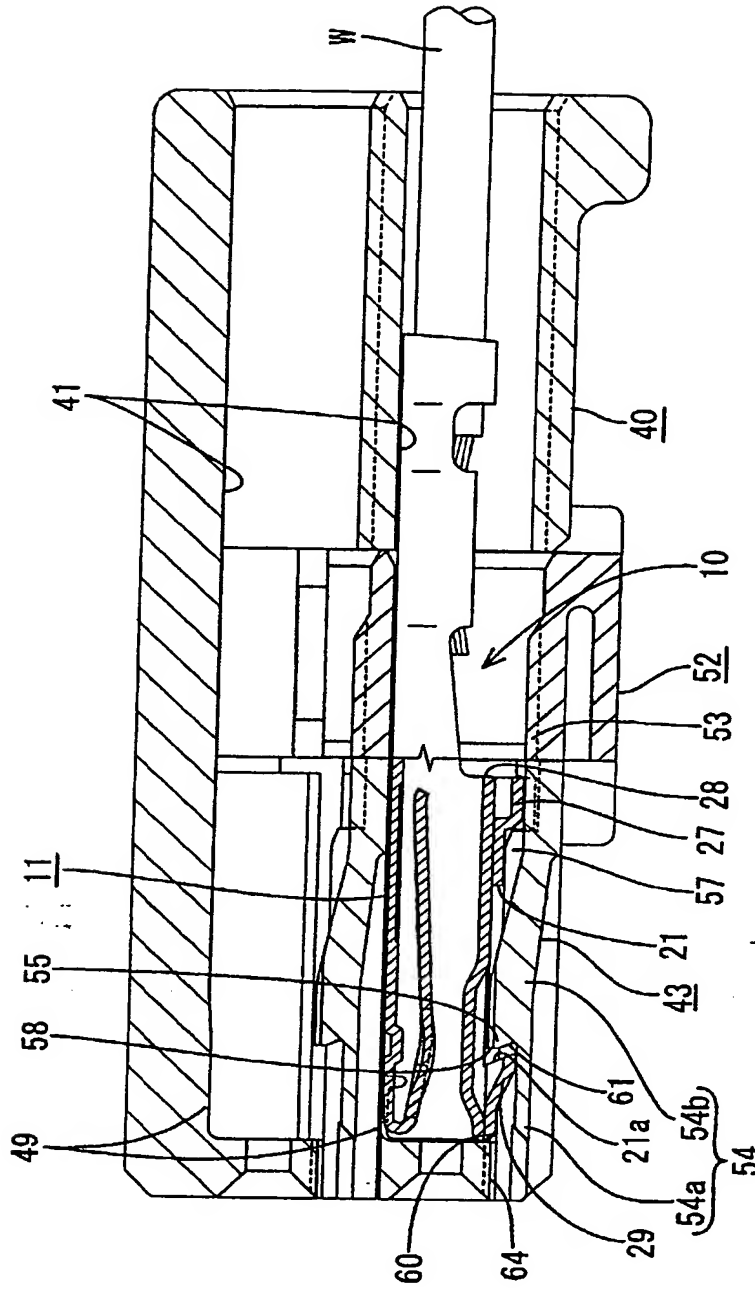


FIG. 12

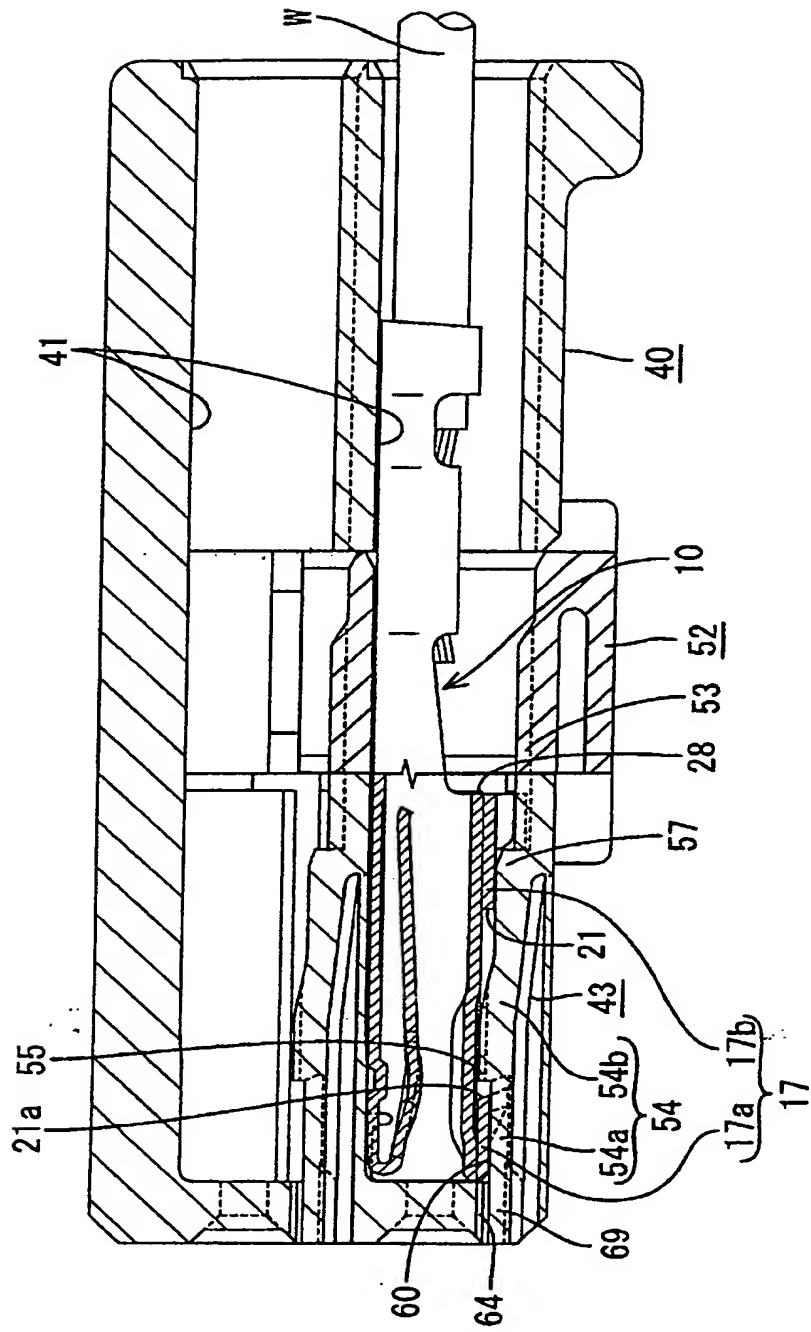


FIG. 13

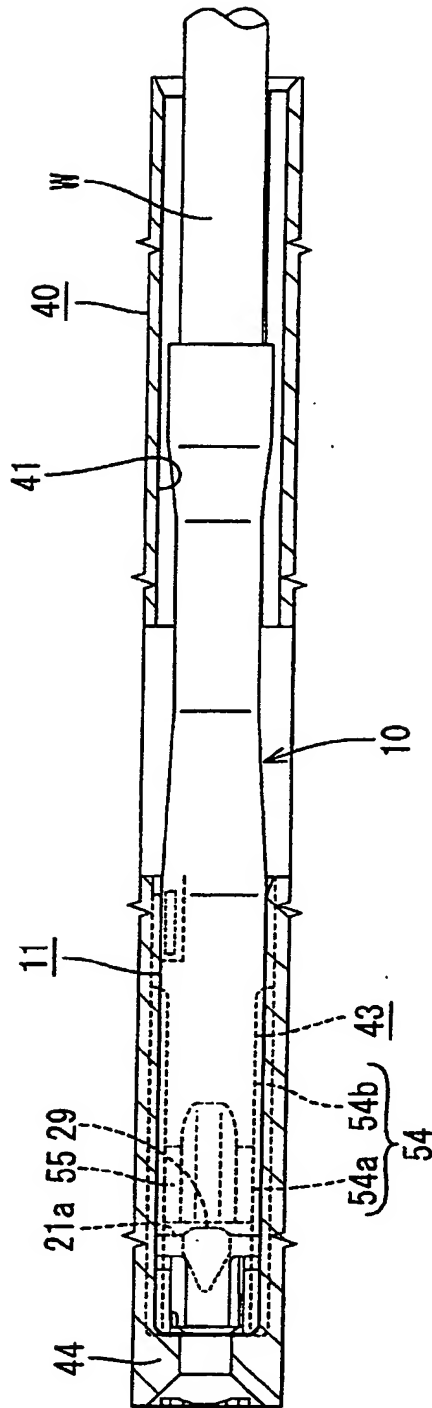


FIG. 14

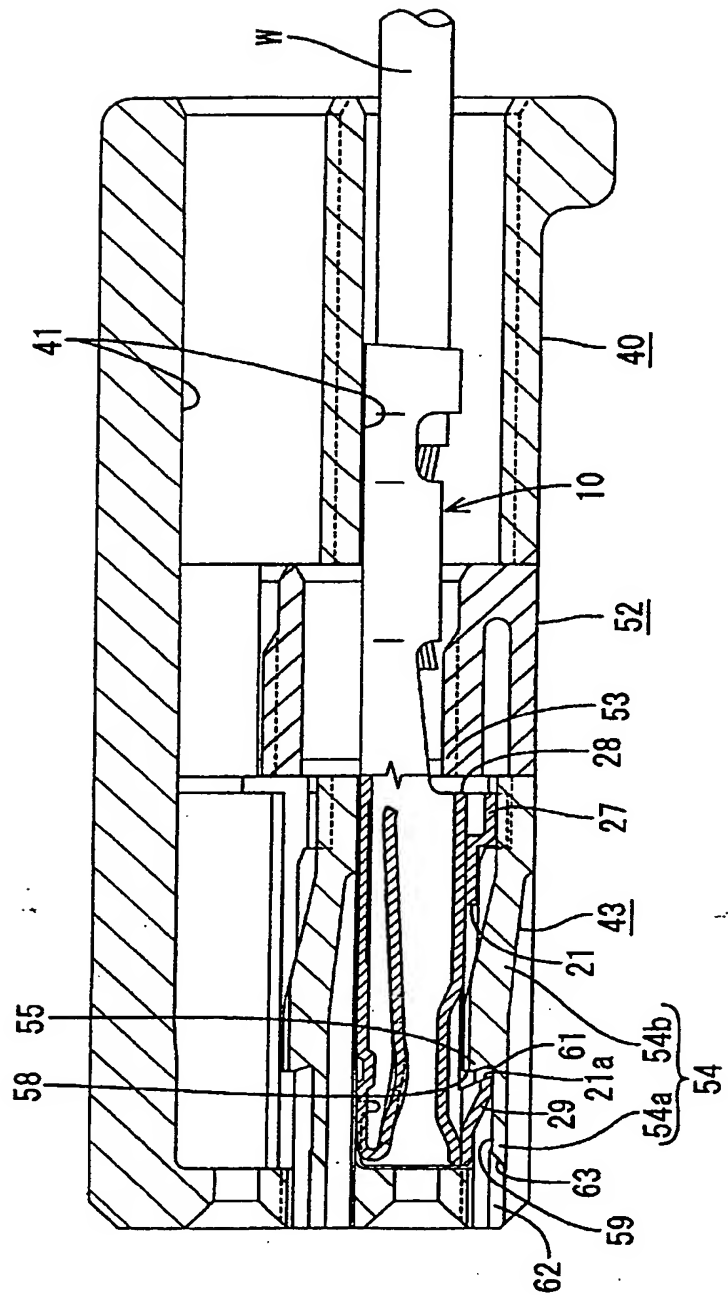


FIG. 15

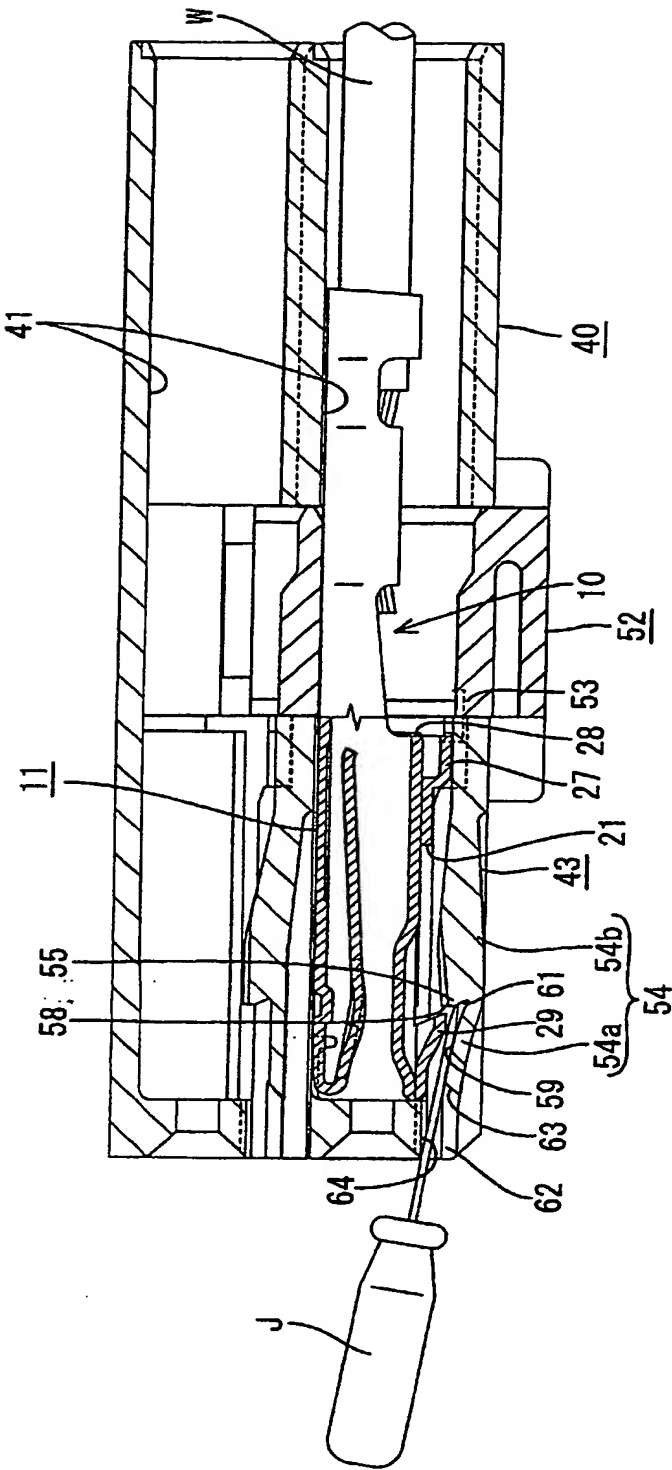


FIG. 16

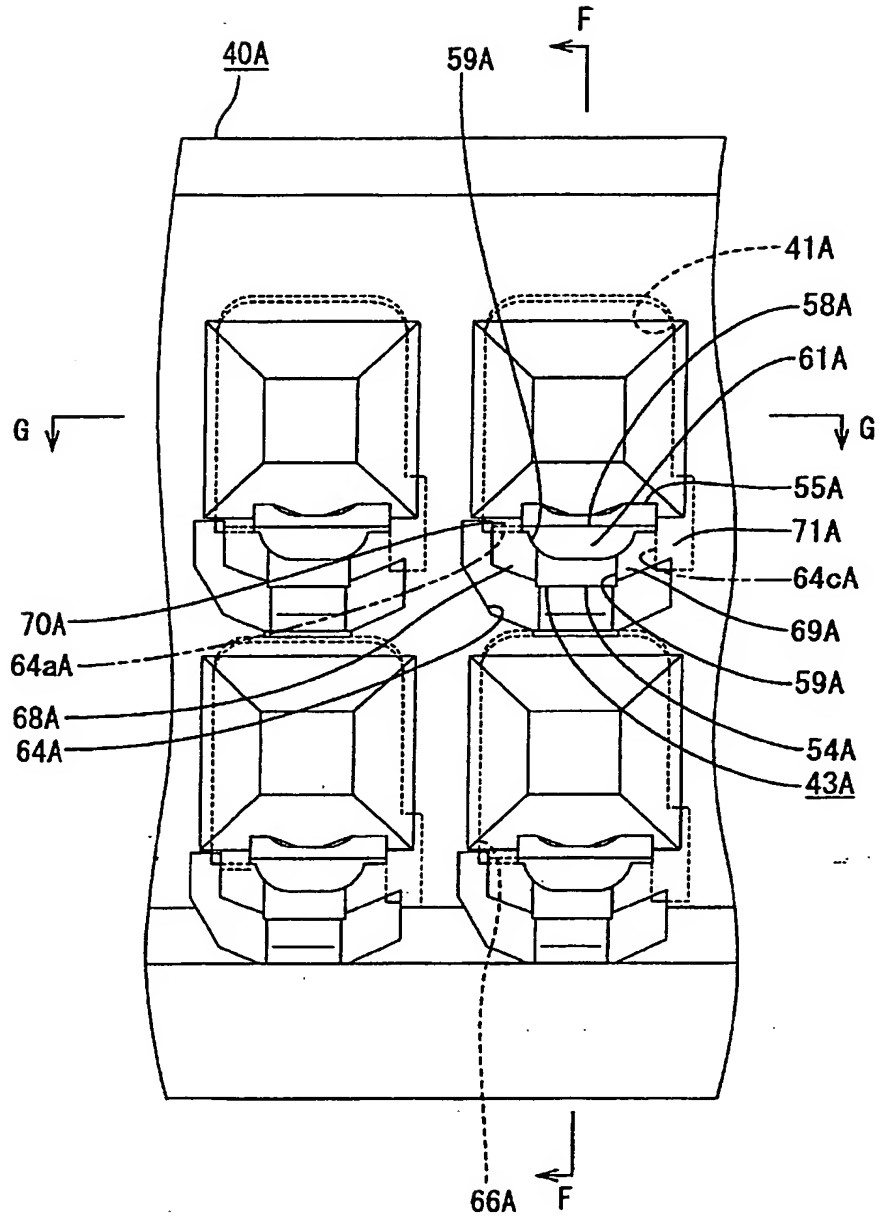


FIG. 17

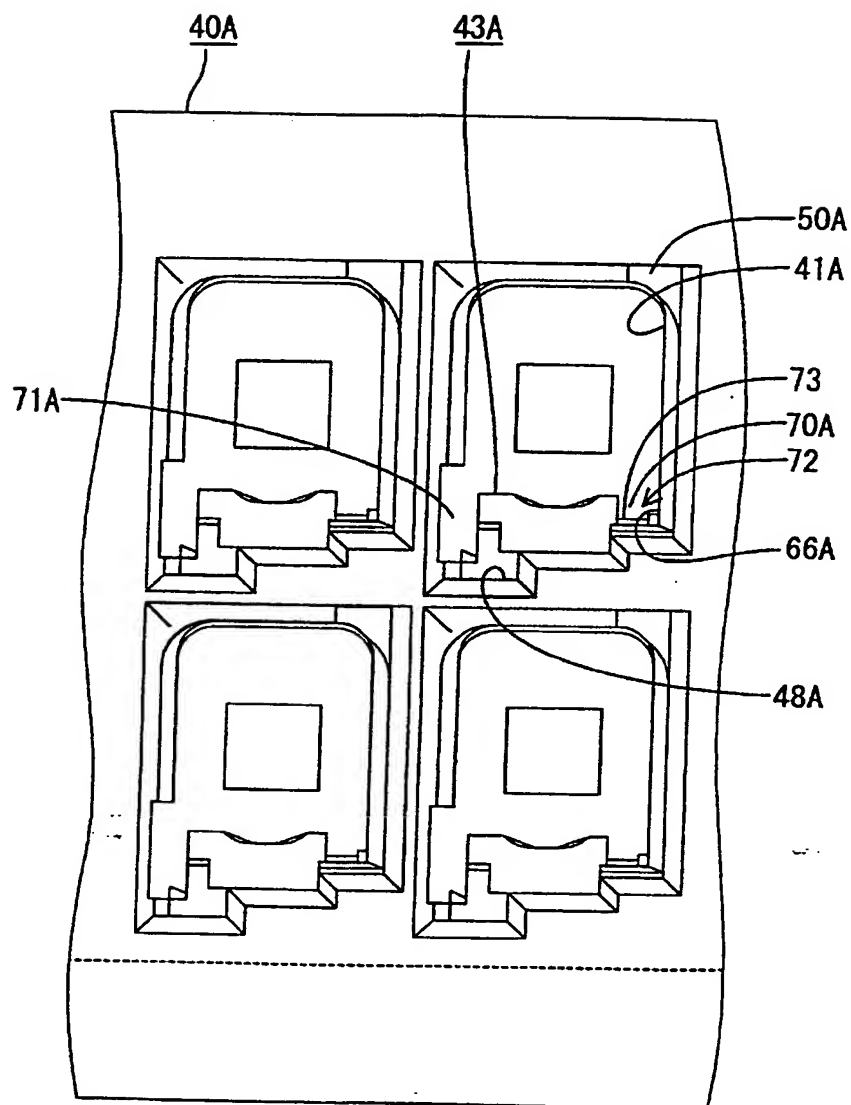


FIG. 18

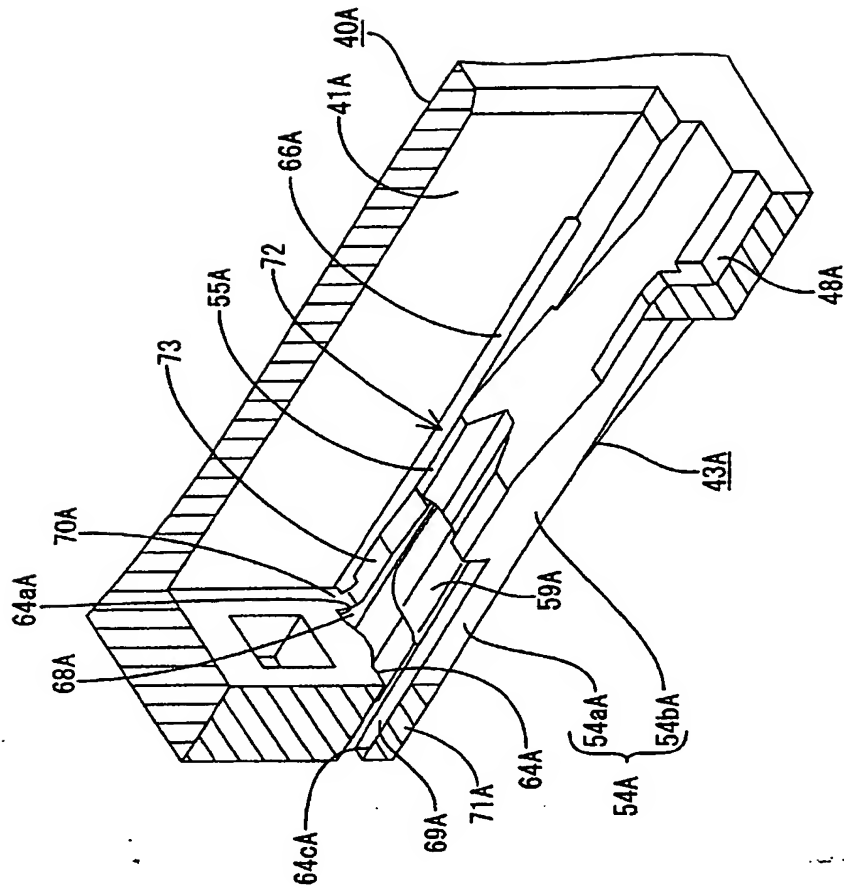


FIG. 19

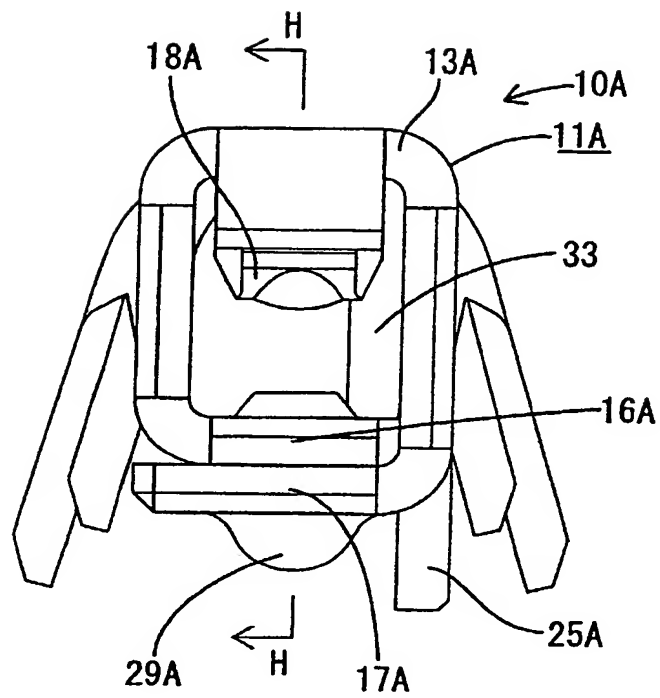


FIG. 20

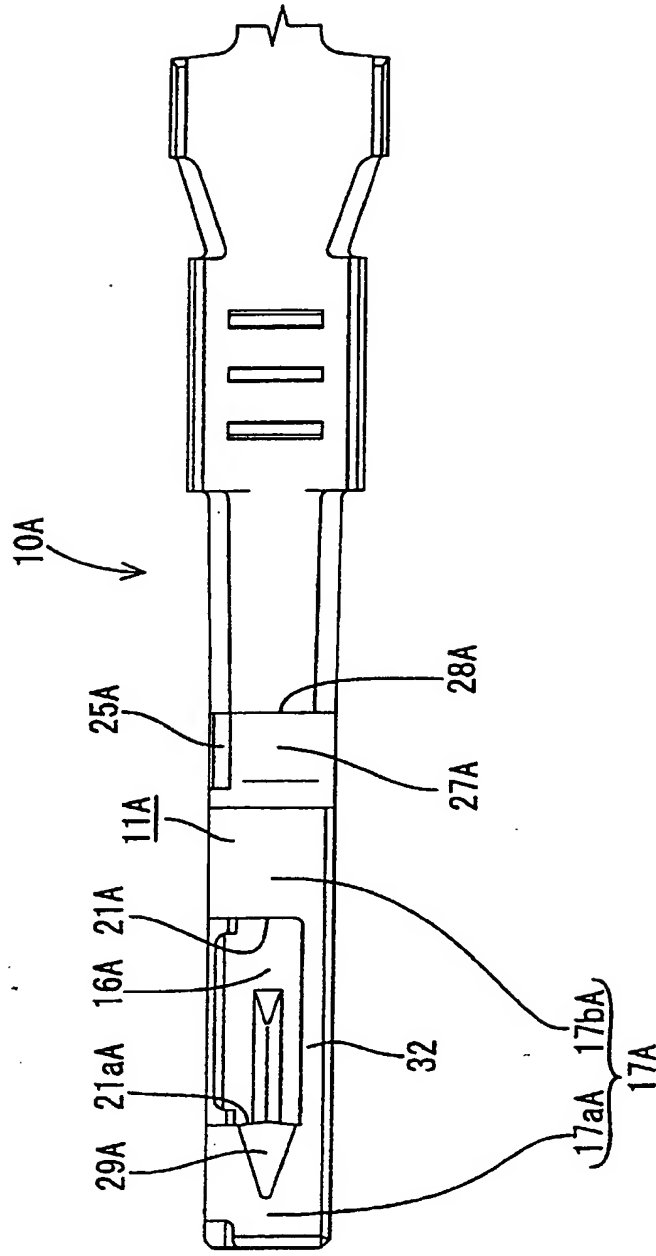


FIG. 21

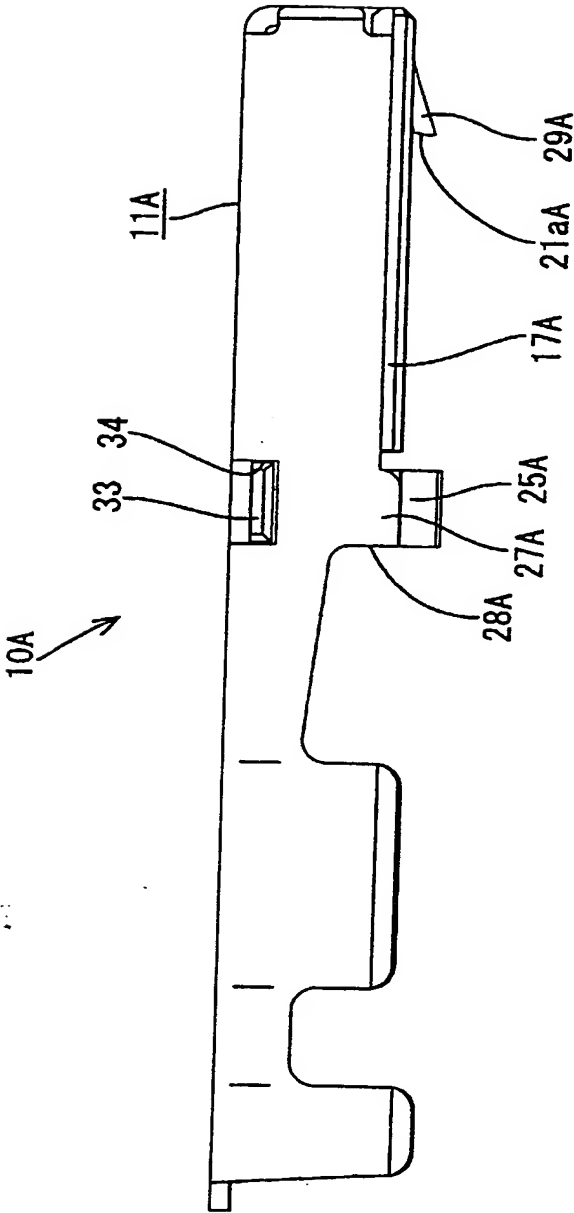


FIG. 22

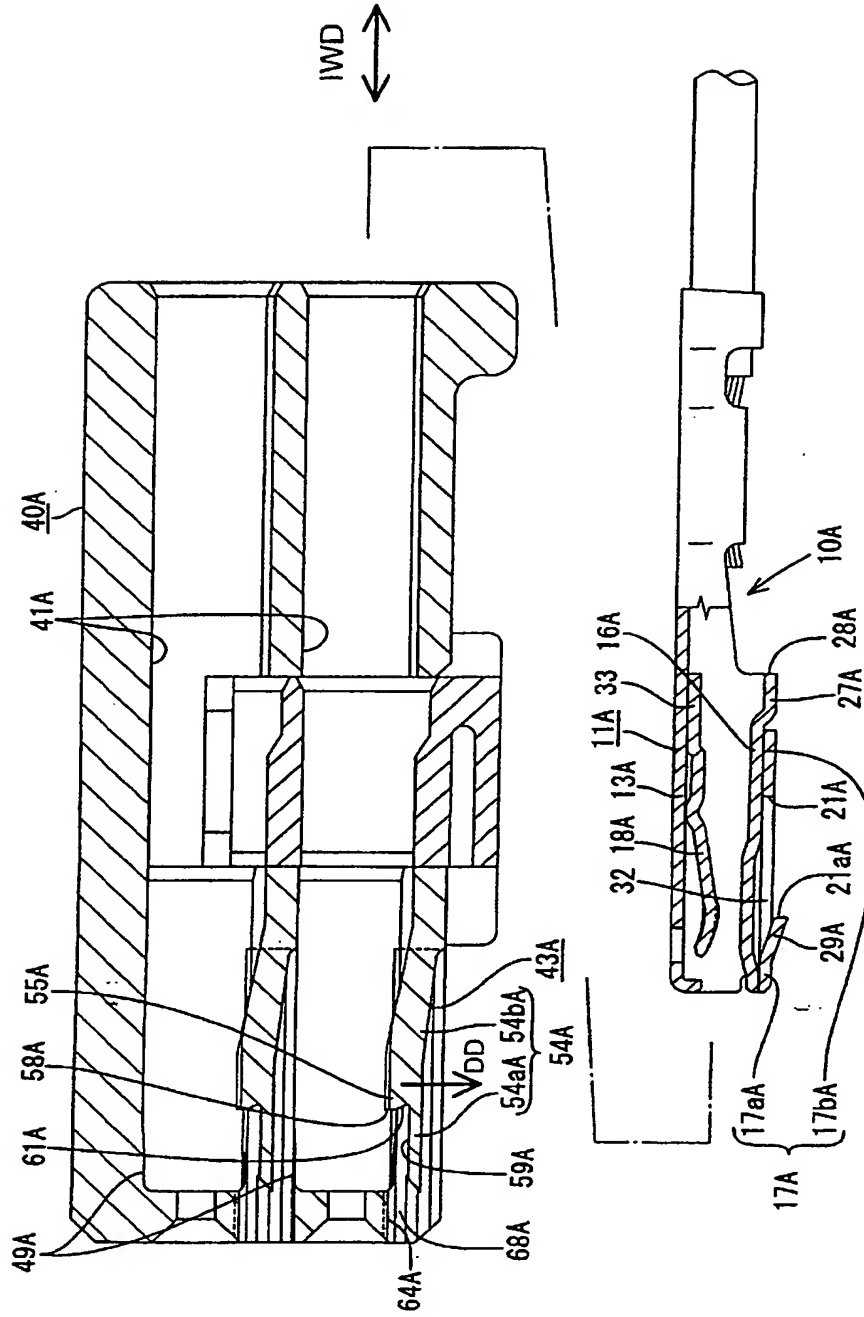


FIG. 23

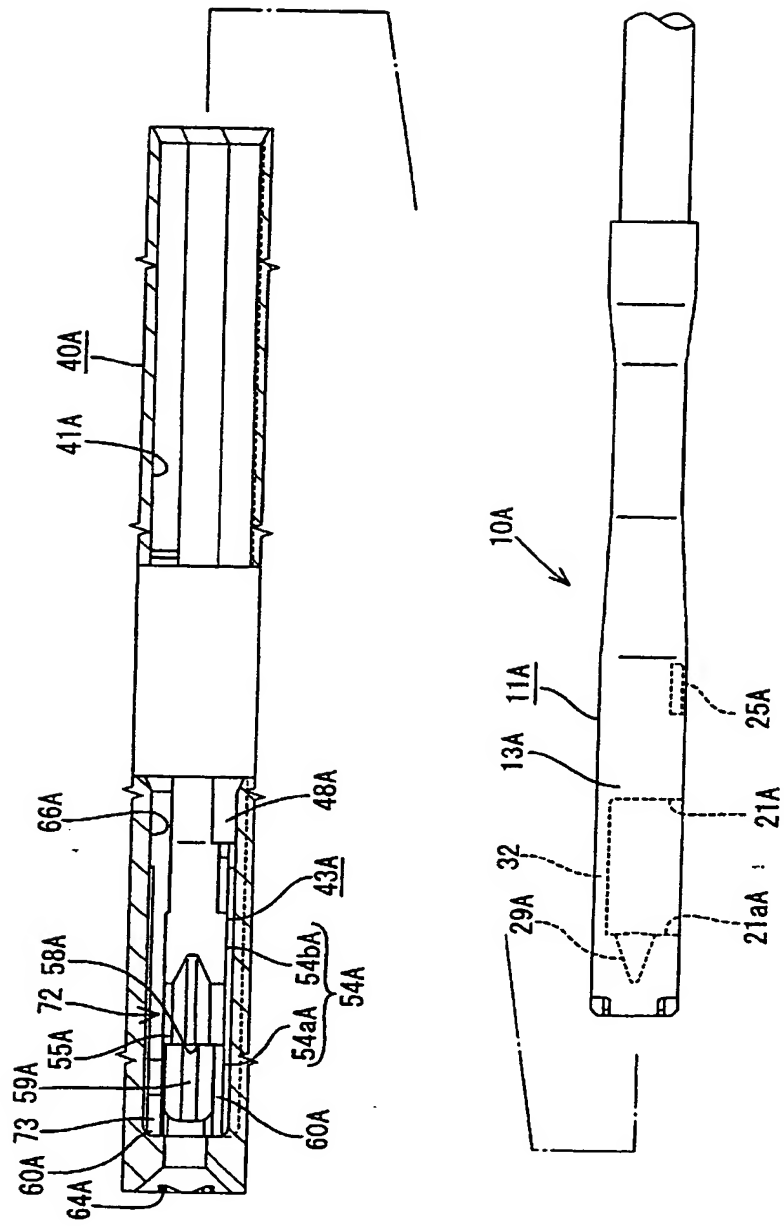


FIG. 24

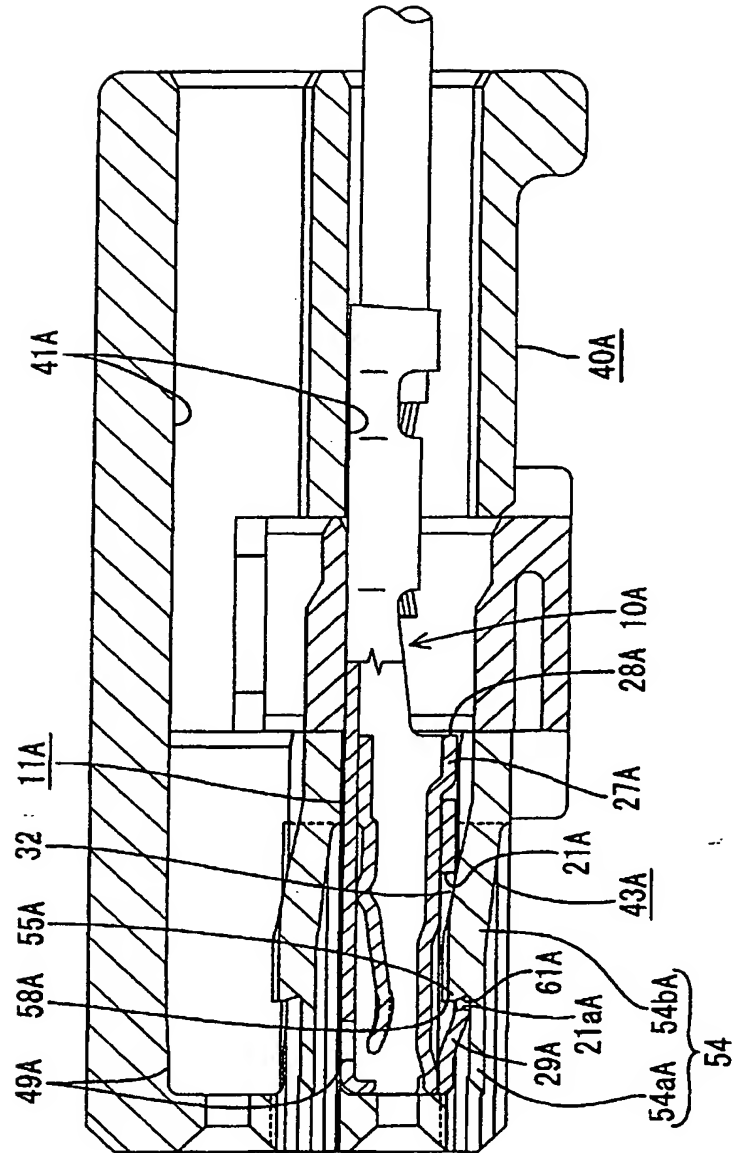


FIG. 25

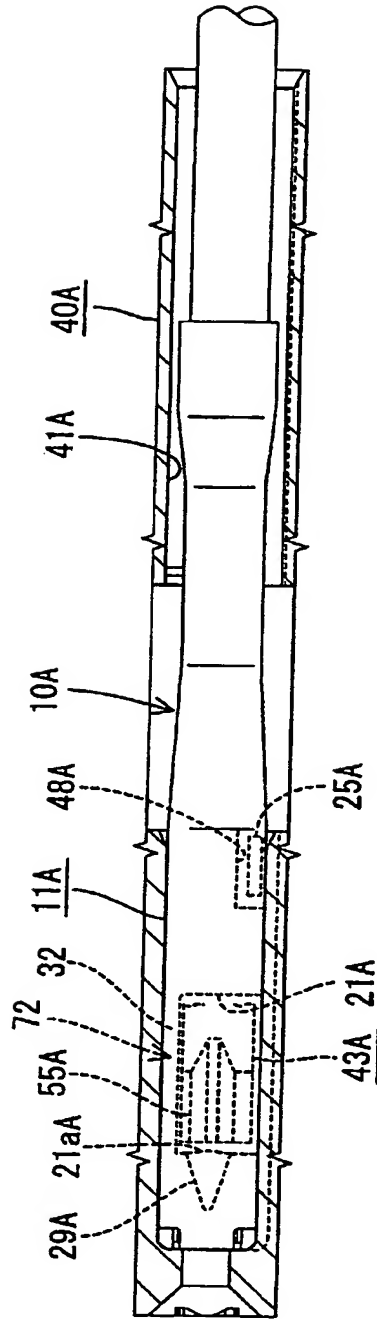
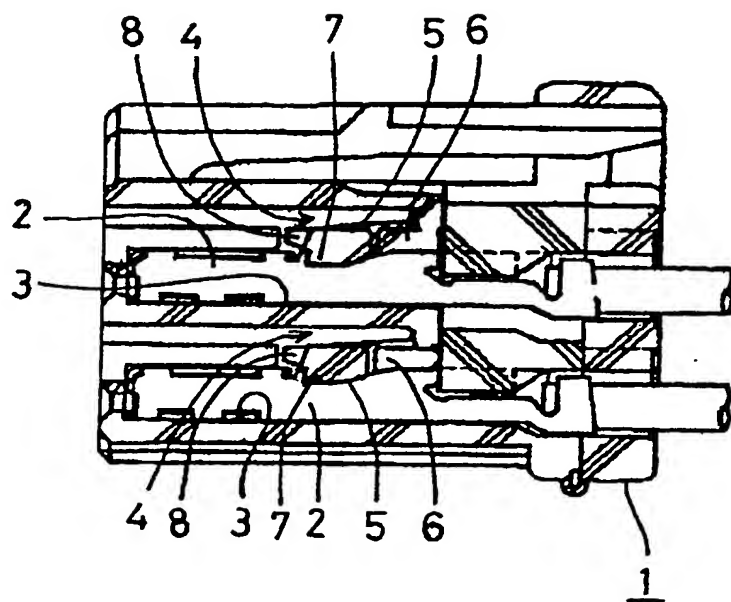


FIG. 26
PRIOR ART





European Patent
Office

EUROPEAN SEARCH REPORT

Application Number
EP 02 01 9154

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int.Cl.7)
X	US 5 575 684 A (MAEJIMA TOSHIHIRO ET AL) 19 November 1996 (1996-11-19) * column 3, line 23 - column 6, line 52 *	1-10	H01R13/422
A	EP 1 209 766 A (YAZAKI CORP) 29 May 2002 (2002-05-29)		
			TECHNICAL FIELDS SEARCHED (Int.Cl.7)
			H01R
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 26 November 2002	Examiner Bertin, M
<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document</p>			

EPO FORM 1503 03/02 (P04001)

**ANNEX TO THE EUROPEAN SEARCH REPORT
ON EUROPEAN PATENT APPLICATION NO.**

EP 02 01 9154

This annex lists the patent family members relating to the patent documents cited in the above-mentioned European search report. The members are as contained in the European Patent Office EDP file on
The European Patent Office is in no way liable for these particulars which are merely given for the purpose of information.

26-11-2002

Patent document cited in search report		Publication date		Patent family member(s)	Publication date
US 5575684	A	19-11-1996	JP	2957084 B2	04-10-1999
			JP	7282883 A	27-10-1995
EP 1209766	A	29-05-2002	JP	2002222672 A	09-08-2002
			CN	1359170 A	17-07-2002
			EP	1209766 A2	29-05-2002
			US	2002064993 A1	30-05-2002

EPO FORM P459

For more details about this annex : see Official Journal of the European Patent Office, No. 12/82

THIS PAGE BLANK (USPTO)